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ABSTRACT

Professional teacher educators recognize that the body of knowledge about teaching and learning is today more substantive, consistent, and authoritative than ever before. It should also be acknowledged, however, that too little of that knowledge is incorporated into the preservice education of teachers. This volume, containing 12 papers presented by eminent scholars at the February 1983 Annual Meeting of the American Association of Colleges for Teacher Education (AACTE) in Detroit, Michigan, represents some valuable current research into essential knowledge for beginning educators--that is, what educators must know to teach effectively. This book concentrates on research into generic components of preservice preparation programs. Those elements, as identified by the program committee of the AACTE meeting, include: (1) instructional planning; (2) management of instruction; (3) management of student conduct; (4) context variables; (5) diagnosis and measurement; and (6) evaluation. In this volume, as at the meeting, two researchers address each area. Also included in this work is a summary paper prepared for the AACTE meeting by B. Othanel Smith and an introduction by Virginia Koehler. The introduction presents a perspective on the evolving state of the art of research dealing with teaching and learning. The summary paper presents a statement and offers clear direction for the improvement of teacher education. (JMK)

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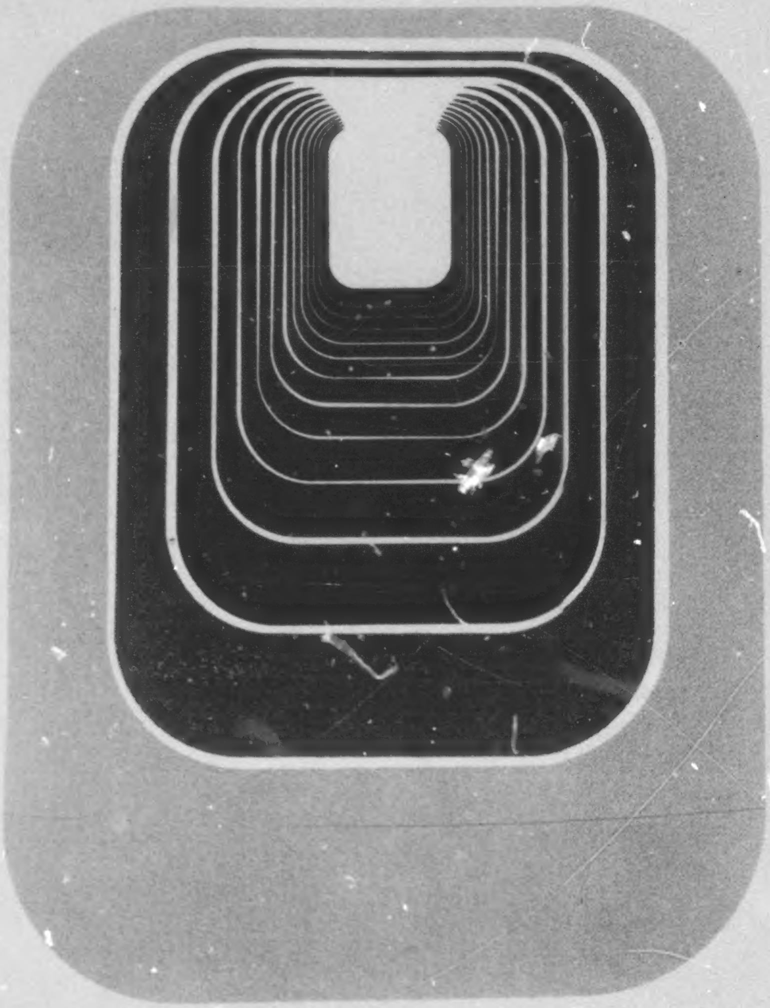

Essential Knowledge for Beginning Educators

David C. Smith
Volume Editor

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Essential Knowledge For Beginning Educators

David C. Smith

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Volume Editor

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Thanks also go to the staff of the ERIC Clearinghouse on Teacher Education—in particular, to Devon Griffith and Michael J. Butler—for editing, proofing, and managing the preparation of this work.

We hope that the research summarized and reported in this book will be of special value to those individuals seeking to improve the quality and rigor of preservice and inservice preparation programs for professional education personnel.

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Essential Knowledge For Beginning Educators

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Preface

Professional teacher educators recognize that the body of knowledge about teaching and learning is today more substantive, consistent, and authoritative than ever before. Yet, we should also acknowledge that too little of that knowledge is incorporated into the preservice education of teachers.

This volume, containing 12 papers presented by eminent scholars at the February 1983 Annual Meeting of the American Association of Colleges for Teacher Education (AACTE) in Detroit, Mich., represents some of the most valuable current research into essential knowledge for beginning educators—that is, what educators must know in order to teach effectively.

Rather than attempt to cover the research base supporting the full range of knowledge contained in teacher preparation programs, this book concentrates on research into generic components of preservice preparation programs. Those elements, as identified by the program committee of the AACTE meeting, include: instructional planning, management of instruction, management of student conduct, context variables, diagnosis and measurement, and evaluation. The papers are ordered in such a fashion as to reflect these areas in this order. In this volume, as at the meeting, two researchers address each area. The present volume offers each scholar's paper as amended following careful outside review and critique.

Also included in this work is a summary paper prepared for the AACTE meeting by B. Othanel Smith and an introduction by Virginia Koehler. The introduction presents a significant perspective on the evolving state of the art of research dealing with teaching and learning. The summary paper represents an important statement by an eminently qualified individual and offers clear direction for the improvement of teacher education.

While this volume does deal with research that is generic in nature, it should be noted that it does not deal with subject-specific knowledge or research associated with the general education background that teachers should possess or subject-specific professional knowledge.

The ERIC Clearinghouse on Teacher Education and AACTE believe that this work will provide vital, consistent, and reliable research data that deserve incorporation in the preparation programs of teachers. The collection is presented to the profession as a contribution toward the preparation of more effective teachers for the youth of our nation.

David C. Smith

Introduction

A Research Base for the Content of Teacher Education

Virginia Koehler
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The Challenge

The challenges faced by teachers today greatly exceed, both in quantity and substance, those faced by teachers 10, 20, or 50 years ago. Curriculum needs are more demanding, accountability systems more pressing, the organization of schools and classrooms more complex, and parental and public demands more insistent. Further, teaching is not viewed as a profession by many people, as indicated by low salaries, public criticism, and mandated instructional and testing systems that undermine teachers' autonomy.

Lowered public esteem for teaching, in combination with other conditions, affects the quantity and quality of entering preservice teacher education majors. Fewer undergraduates are entering teaching, and those who do are often among the least academically able college students (Weaver 1979; Schlechty and Vance 1982).

The place to begin to reverse these conditions is at the level of preservice teacher education: What must teacher candidates learn in order to become effective teachers? This volume, incorporating the views of prominent educators from across the nation, represents an initial step toward answering that question.

The Content of Teacher Education

The professionalism of teaching depends on the growth of a substantial, viable base of knowledge about learning processes and effective schooling. Fortunately, as B. Othanel Smith points out in this volume, education's knowledge base has experienced encouraging growth in recent years. Some important areas of clinical knowledge, treated in the papers that follow, are:

Effective teaching. Heath and Nielson (1972) spoke too soon when they concluded, after a review of teacher-effectiveness studies, that: "Given measured growth in student cognitive achievement as criteria and teaching behavior as the independent variable, we find no reliable evidence of stable relationships" (p. 75). This conclusion was published just prior to a major breakthrough in our understanding of effective teaching. The work by Stallings (1976), Brophy and Evertson (1974), Good et al. (1978), McDonald (1976), and others began to indicate that the effective teacher is an effective classroom manager; that students of teachers who manage to keep students in contact with the content of the curriculum will learn more than students of teachers who manage less well. This work, brought together and extended in the Beginning Teacher Evaluation Study conducted by David Berliner and Charles Fisher, was described in the popular book *Time to Learn* (Denham and Lieberman 1980). Further, while this early work was correlational, subsequent work was experimental (Anderson and Brophy 1973; Gage and Crawford 1978; Stallings et al. 1978; Good and Grouws 1983). Using the findings of correlation studies to train teachers in management skills, these researchers found that students of the trained teachers gained more in achievement scores than did similar students with teachers who were not so trained.

Interestingly, this work has become integrated into many inservice education programs but much less into preservice education. In a major study of practice teaching, for example, in which a sample of triads (student teacher, clinical supervisor, and cooperating teacher) was intensely studied, researchers found little content related to effective teaching research in the dialogues between the student teachers and the clinicians (Griffin 1983).

Certainly, research on effective teaching seems more immediately applicable to inservice teacher education. Interventions related to classroom management are more easily implemented when the trainee or teacher has had experience in managing a classroom. However, this knowledge base should be incorporated into the preservice curriculum, although not necessarily through classroom lecture. Even if trainees learn this knowledge formally, they may not use it effectively in the classroom. (Scores on paper-and-pencil measures of classroom management do not systematically predict actual classroom behavior.) Effective teaching research should, however, be the essential knowledge base of clinical supervisors and cooperating teachers who guide students through practice teaching. Such a knowledge base can also be used for simulation exercises as a part of methods courses.

The language of the classroom. Social linguistic analyses of classroom language have revealed many problems in classroom communication, particularly between teachers and students differing in cultural heritage, socioeconomic status (SES), and ethnic background. In particular, misunderstandings often occur over the unspoken rules of classroom communication: when, how, and to whom to speak. (Recent work in this area is summarized in Green and Smith 1983.) For example, students are allowed to request help from peers in some situations and not in others. These rules differ from classroom to classroom and are seldom explicated by the teacher. Classroom questioning is another area where the rules for use and response are unclear. Teachers use questioning for multiple purposes, for example, to determine whether a student understands or to recapture the attention of the rest of the class. Students do not always understand these purposes and may not respond appropriately. This can lead to misunderstandings, lowered expectations, and lower achievement.

Classroom language is one of the primary means of transmitting knowledge to students, particularly in elementary schools. Greater emphasis should be placed on the social as well as academic roles of language in the classroom in preservice teacher education.

Teacher planning and decision-making research. A significant proportion of the teaching task consists of teachers making professional decisions and judgments about what their students have learned, should learn, and are learning, and what instructional activities are appropriate. Research on the ways that experienced teachers plan presents a description that conflicts with the way planning has been taught in preservice education. This work indicates that most teachers follow an activities-oriented approach to planning that concentrates on the content, climate, materials, and activities to be covered, and how to adapt them to the pupils. However, most teacher trainees have been trained in the rational approach to planning: a focus on learning objectives from which the teacher generates or identifies a range of instructional activities that might be useful in accomplishing the objectives and selects from among the alternatives those activities that would be most appropriate. Further, the actual cycles of planning do not correspond with the daily lesson plans, the unit most often stressed in training (Shavelson and Stern 1981).

Two conclusions may be drawn from this research. One is that preservice teacher education should operate within the framework of actual practice and provide teachers with ways to improve the process. For example, research indicates that when plans go awry during teaching, many teachers continue as planned because they cannot think of alternative directions. Preservice education should provide trainees with more alternatives and a better understanding of what can go wrong. Another conclusion is that preservice educators are not doing a good job of training teachers in the rational planning approach. Teacher educators must conduct experimental research on this important issue.

The effects of context on teaching. Research has demonstrated that context factors such as type of student, grade level, subject matter, curriculum, and organizational context have powerful effects on teaching and help to define what is effective (Brophy and Evertson 1976). The community has also been shown to have an effect on the school (Hamilton 1982). It also seems that socialization of new teachers by students, other teachers, school philosophy, etc., is more powerful than methods courses in preservice teacher education (Copeland 1971). These context effects may explain why no one teaching style has emerged as more effective than others. Therefore, practice teachers who learn from cooperating teachers or clinical supervisors that one particular style or program is best, or who learn only situation-specific behaviors as in the Griffin (1983) study, may have problems teaching in unfamiliar or unpredictable settings.

Methods courses should, therefore, begin to reflect a more ecological view that helps trainees understand the relationship between context factors and effective teaching: that there is no one correct way to teach, but that effectiveness depends, to a certain degree, on context factors.

Effective schools research. Recent reviews of studies concerned with school effectiveness have provided a firm knowledge base regarding the conditions necessary for improving and sustaining instructional effectiveness in elementary schools (see, for example, Purkey and Smith 1982; Cohen 1983). This research points to the need for school-district support; sound, school-based, staff-development programs; a strong principal's leadership; a safe and orderly climate; and high expectations for student achievement on the part of the school community. Further research has identified the need for collegiality among staff members (Little 1981).

Several elements of this research are particularly important for preservice teacher trainees to understand: (1) that some schools and teachers are more effective than others—controlling for the type of student; and (2) that the behavior of the professionals (teachers and administrators) in those schools makes the difference between effectiveness and ineffectiveness. A recent study of teachers' sense of efficacy, for example, indicated that nonefficacious teachers tended to blame their students for problems in their classrooms while more efficacious teachers blamed themselves and their instructional and management systems (Ashton et al. 1983). The attitude that teachers make a difference in student learning should be developed in preservice trainees, as well as an understanding of the importance of professional collegiality in effective schools.

Research on reading, writing, and mathematics learning. Recent research on reading comprehension, studies of how young students learn to write, and mathematical error analyses should be incorporated in preservice teacher education curricula. Research on reading diagnosis, for example, indicates that teachers who are provided with a coherent theory of reading and how children learn to read are more reliable in their reading diagnoses; and training in reading diagnosis itself may be aided by practice with computerized cases (Wagner et al. 1982). But these theories have not been transmitted to many classroom teachers, including many who teach reading.

Conclusion

Faced with decreasing enrollments and financial support, a limited time with which to work with preservice trainees, and state-mandated curricula, schools of education may well wonder why the burden for improving the quality of teaching has fallen on them. Teacher educators may feel that constraints on their system make it impossible to change schools of education to the degree necessary to improve the quality of teaching. Nonetheless, the new clinical knowledge of pedagogical education may be incorporated into preservice education without radically changing the structure of schools of education. Structures must, however, be developed within teacher education institutions to encourage constant updating of the knowledge base. Most important, as has been demonstrated at the inservice level, transmission of this knowledge base to teachers will increase the quality of teaching. This, then, is the challenge of the 1980s.

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Research on Teacher Planning: An Inventory of the Knowledge Base

Christopher M. Clark
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What does research on teacher planning offer that might be called essential knowledge for beginning educators? To answer this question, I have summarized the major studies of teacher planning and derived some ideas about how the research may be applied to the practice of teacher education.

I want to be clear from the outset that I believe that knowledge about teaching derived from research is important to the preparation of teachers and to the professional development of experienced teachers. That is why I have devoted the last ten years of my professional life to research on teaching. But I also want to state that research-based knowledge, no matter what its quality or extensiveness, will never provide a complete and sufficient basis for teacher education or for the practice of teaching. Research can help us to think about teaching and teacher preparation more clearly, but these professions have fundamentally practical, clinical, and artistic dimensions that exceed the scope of the social and behavioral sciences. Excellence in teaching and teacher preparation are not puzzles to be solved once and for all by a research breakthrough. Rather, they are ideals to be pursued continually by dedicated professionals who draw upon all of their knowledge, insight, imagination, and creativity to make the most of an ever-changing present. Today I hope to contribute a few grains of knowledge to this quest.

My presentation includes four parts: (1) an introduction that deals with the classes of knowledge derived from research on teaching, (2) a brief history of the beginnings of research on teacher thinking, (3) a summary of the main questions and findings of research on teacher planning, and (4) my conclusions, derived from this research, which I nominate as essential knowledge for beginning educators.

Research on Teaching and Teacher Education

When I think about research on teaching in relation to essential knowledge for beginning educators, I think of two kinds of knowledge and two kinds of research. The first kind of research is that which is collectively called teacher-effectiveness research. This paradigm typically uses correlational and quasi-experimental designs to detect relationships between relatively specific teacher-behavior variables on the one hand and student achievement variables on the other. These teacher-behavior variables are defined *a priori* and incorporated into an observation schedule or manipulated through training. Most teacher-effectiveness research has been concerned with discovery of procedural knowledge about effective teaching, that is, with discovering how effective teachers behave and how teacher educators can help prospective teachers do likewise. Teacher-effectiveness research has produced a large and valuable knowledge base concerning the skills used in orchestrating clear, efficient, and well-organized classroom instruction that has measurable effects on certain classes of student achievement (usually decoding of text and arithmetic computation). It is a relatively straightforward process to translate knowledge from teacher-effectiveness research into prescriptions for teacher education. Indeed, the curricula of most of our microteaching clinics and the content of competency-based teacher education programs are direct translations of this research base into teacher education.

But there is a second category of knowledge that I believe is also essential for beginning educators: propositional knowledge. Propositional knowledge is knowledge that something exists, is true, or is important in particular circumstances. Propositional knowledge is not prescriptive, but rather definitional and conceptual. Propositional knowledge provides conceptual categories that are useful as we organize, visualize, make sense of, and communicate about complex experiences such as teaching. Research on teacher thinking, planning, and decision making is aimed at increasing our propositional knowledge base about the practice of teaching and toward communicating that propositional knowledge to beginning and experienced educators alike. This second kind of research on teaching is largely descriptive, and depends heavily on reflection and self-report by teachers to produce descriptions in a way that is faithful to the teacher's perspective.

Of course, teacher-effectiveness research has provided some conceptual contributions, such as "wait time," "time on task," and "higher-order questions." And I suspect that research on teacher thinking will also provide knowledge about planning skills and decision-making skills at some future time. But the point here is that these two paradigms for research on teaching differ in their primary goals. Teacher-effectiveness researchers are primarily concerned

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with producing knowledge about the observable behavior of effective teachers. Researchers on teacher thinking pursue knowledge about how teachers' minds work as they plan, make decisions, teach, and reflect on experiences.

Fortunately, these differences do not make for direct competition between paradigms, but rather foster a complimentary relationship. Philip Jackson, in his paper entitled "The Way Teaching Is" (1966), argued that there could be a mutually supportive relationship between teacher-effectiveness research and research on teacher thinking. Calling the preactive domain of teacher thinking the "hidden side" of the profession, Jackson reasoned that "a glimpse at this 'hidden side' of teaching may increase our understanding of some of the more visible and well known features of the process" (p. 12). In so saying, Jackson implied that neither kind of knowledge suffices, by itself, to provide an adequate basis for understanding teaching.

Jackson's proposition reminds me of a book that I read recently on fly fishing. I am a novice trout fisherman, and this book was written for beginners such as myself. About three-quarters of the book consisted of procedural knowledge: how to select balanced tackle, how to perform various casts, how to keep records of successes and failures. But the remaining quarter of the book was composed of narratives in which the author described, in vivid detail, some of his own fly-fishing episodes. Both of these kinds of information were important to me as a learner. The narratives permitted me to visualize myself in a real setting using the skills diagrammed and described elsewhere in the book. The skill instruction gave me an expert's ideas about what I should practice and how I should behave on a trout stream, but not how to *think like a fisherman*. Neither part of the book would have been sufficient, by itself, to get me out on a trout stream with much chance of satisfaction. But, in combination, the generic, abstract, procedural knowledge and the rich, vivid, situation-specific, propositional knowledge made a complete, powerful package. I believe that this combination of generic skills training and the study and analysis of written case studies of teaching could be used to good effect in teacher preparation.

Research on Teacher Thinking

Before considering the specifics of the knowledge base derived from research on teacher planning, I want to provide a brief summary of the assumptions and early history of research on teacher thinking. The thinking, planning, and decision making of teachers constitute a large part of the psychological context within which a curriculum is interpreted and acted upon and within which teachers teach and students learn. Teacher behavior is substantially influenced and even determined by teachers' thought processes. These are the fundamental assumptions behind the literature that has come to be called research on teacher thinking. Researchers on teacher thinking seek first to describe the mental lives of teachers. Second, they strive to understand and explain how and why the behaviorally observable activities of teachers' professional lives take on the forms and functions that they do. They ask when and why teaching is difficult and how human beings manage the complexity of classroom teaching. The ultimate goal of research on teachers' thought processes is to construct a portrayal of the cognitive psychology of teaching for use by educational theorists, researchers, policy makers, curriculum designers, teacher educators, school administrators, and teachers themselves.

Philip Jackson's *Life in Classrooms* (1968) reported one of the earliest empirical attempts to describe and understand the mental constructs and processes that underlie teacher behavior. The descriptive character of Jackson's study was a striking departure from contemporary research on teaching and did not fit easily with the then dominant teacher-effectiveness research paradigm. In 1968, it was difficult to see how description of life in a few classrooms could contribute much to the quest for teaching effectiveness. But the real power of Jackson's research was not to be found in prescriptions for teaching that might be derived from the work. Rather, Jackson's contribution to research on teaching was conceptual. He portrayed the full complexity of the teacher's task, made conceptual distinctions that fit the teacher's frame of reference (such as that between the preactive and interactive phases of teaching), and called the attention of the educational research community to the importance of describing the thinking and planning of teachers as a means to fuller understanding of classroom processes.

In Sweden, Dahllof and Lundgren (1970) conducted a series of studies of the structure of teaching as an expression of organizational constraints. While this work was primarily concerned with the effects of contextual factors on teaching, it revealed some of the mental categories that teachers use to organize and make sense of their professional experiences. As with Jackson, the Dahllof-Lundgren contribution was primarily conceptual. Of particular significance in the Dahloff-Lundgren research was the phenomenon of the "steering group," a small subset of a class (ranging in achievement level from the tenth to twenty-fifth percentiles) that teachers used as an informal reference group for decisions about pacing a lesson or unit. During whole-class instruction, when the students in the steering group seemed to understand what was being presented, the teacher would move to a new topic. But when the teachers believed that the steering-group students were not understanding or performing up to standards, the teachers slowed the pace of instruction for all. The steering group is important as a concept both because of its empirical verifiability and because it shows clearly how teachers' mental categories can have significant pedagogical consequences.

In June 1974, the National Institute of Education convened a week-long National Conference on Studies in Teaching to create an agenda for future research on teaching. Participants in this planning conference were organized into 10 panels, and each panel produced a plan for research in their area of expertise. The deliberations of Panel 6—entitled "Teaching as Clinical Information Processing"—were of particular importance to the development of research on teachers' thought. Lee S. Shulman, chair of Panel 6, had assembled a diverse group of experts on the psychology of human information processing, the anthropology of education, classroom-interaction research, and the practical realities of teaching. The panel produced a report (National Institute of Education 1975) that provided a rationale for and defined the assumptions and the domain of a proposed program of research on teachers' thought processes. The panelists argued that research on teacher thinking is necessary if we are to understand that which is uniquely human in the process of teaching.

> It is obvious that what teachers do is directed in no small measure by what they think. Moreover, it will be necessary for any innovations in the context, practices, and technology of teaching to be mediated through the minds and motives of teachers. To the extent that observed or intended teacher behavior is "thoughtless," it makes no use of the human teacher's most unique attributes. In so doing, it becomes mechanical and might well be done by a machine. If, however, teaching is done and, in all likelihood, will continue to be done by human teachers, the question of the relationships between thought and action becomes crucial. (p. 1)

Beyond this logical argument for attending to teacher thinking, the Panel 6 report went on to cite research on human information processing, which indicated that a person, when faced with a complex situation, creates a simplified model of that situation and then behaves rationally in relation to that model. The resulting behavior, as indicated by Simon, "is not even approximately optimal with respect to the real world. To predict . . . behavior we must understand the way in which this simplified model is constructed, and its construction will certainly be related to [one's] psychological properties as a perceiving, thinking, and learning animal" (1957; cited in National Institute of Education 1975, p. 2). To understand, predict, and influence what teachers do, the panelists argued, researchers must study the psychological processes by which teachers perceive and define their professional responsibilities and situations.

The Panel 6 report was explicit about the view of the teacher that guided the panelists in their deliberations and recommendations for research:

> The Panel was oriented toward the teacher as clinician, not only in the sense of someone diagnosing specific forms of learning dysfunction or pathology and prescribing particular remedies, but more broadly as an individual responsible for (a) aggregating and making sense out of an incredible diversity of information sources about individual students and the class collectively; (b) bringing to bear a growing body of empirical and theoretical work constituting the research literature of education; somehow (c) combining all that information with the teacher's own expectations, attitudes, beliefs, purposes . . . and (d) having to respond, make judgments, render decisions, reflect, and regroup to begin again. (pp. 2-3)

In short, the Panel 6 report presented an image of the teacher as a professional who has more in common with physicians, lawyers, and architects than with technicians who execute skilled performances according to prescriptions or algorithms defined by others. This view of the teacher as professional has had a profound effect on the questions asked, methods of inquiry employed, and form of results reported in research on teacher thinking. Moreover, the report influenced new initiatives in research on teaching in a more instrumental way: In 1975, the National Institute of Education issued a request for proposals for an Institute for Research on Teaching that would focus on research on teaching as clinical information processing. An Institute for Research on Teaching was established at Michigan State University in 1976, and this organization initiated the first large program of research on the thought processes of teachers. Now, with this as background, let us look more closely at one part of research on teacher thinking—that on teacher planning.

Planning Defined

As a subject of research, planning has been defined in two ways. First, we may say that planning is a basic psychological process in which a person visualizes the future, inventories means and ends, and constructs a framework to guide his or her future action. This definition leads to research on the process of planning that draws heavily from the theories and methods of cognitive psychology. At another level of abstraction, we may define planning (somewhat circularly) as "the things that teachers do when they say that they are planning." This definition suggests a phenomonological or ethnographic approach to research on teacher planning, in which the teacher takes on an important role as informant or even as research collaborator.

Both of these definitions of teacher planning are represented in the research literature either explicitly or by implication. I believe that these differences in thought about what planning is account for the variety of methods of inquiry in use and for the challenge that reviewers of this literature face in pulling together a coherent summary of what has been learned. Planning is challenging to study because it is both a psychological process and a practical activity.

The following section of this review, in which the results of selected studies of teacher planning are summarized, is organized to answer three major questions that researchers have been pursuing: (1) What are the types and functions of teacher planning? (2) What models have been used to describe the process of planning? and (3) What is the relationship between teacher planning and subsequent action in the classrooms?

Types and Functions of Teacher Planning

What are the different kinds of planning that teachers do, and what purposes do they serve? The answer to both parts of this question seems to be "many." That is, many different kinds of planning are in use, and many functions are served by these processes. More specific answers come from several recent studies of teacher planning.

Two of these studies were designed in part to determine the kinds of planning experienced teachers engage in. Yinger (1977) studied the planning decisions of a single first/second grade teacher over a five-month period. Using interviews, thinking aloud, and extensive classroom observations, Yinger determined that the teacher engaged in five kinds of planning: yearly, term, unit, weekly, and daily. The activity was found to be the basic unit of daily and weekly planning. The teacher drew heavily on routines established early in the school year that incorporated learning outcomes for students. These routines were seen as reducing the complexity and increasing the predictability of classroom activities.

In a second study by Clark and Yinger (1979), 78 teachers wrote general descriptions of their planning and selected and described three examples of their plans representing the three most important types of planning that they did during the year. These teachers reported that they engaged in eight types of planning, including the following in order of frequency of mention: weekly, daily, unit, long-range, lesson, short-range, yearly, and term. Unit planning was most often identified as the most important type of planning, followed by weekly and daily planning. Only 7% of the teachers in this study listed lesson planning among the types of planning most important to them.

The dynamic relationships among different types of planning have been studied to a modest degree. Two studies by Greta Morine-Dershimer (1976; 1979) suggested that teachers' plans are seldom fully reflected in their written plans. Rather, the details recorded in a written plan are nested within more comprehensive planning structures called "lesson images." These lesson images, in turn, are nested within a still larger construct, called the "activity flow" by Joyce (1978-1979). For elementary teachers, the activity flow encompasses the year-long progress of a class through each subject and the balance of activities across subjects in a school day or week.

Further support for the idea that teacher planning is a nested process came from a study by Clark and Elmore (1979). They interviewed and observed five elementary teachers during the first five weeks of the school year and found that their planning was primarily concerned with setting up the physical environment of the classroom, assessing student abilities, and establishing the social system of the classroom. By the end of the fourth week of school, a system of schedules, routines, and groupings for instruction was established. These structural and social features of the classroom then persisted throughout the school year and served as the framework within which particular activities and units were planned. Other studies of the first weeks of school also have supported the conclusion that, to a significant degree, the "problem space" (after Newell and Simon 1970) within which teachers and students operate is defined early, changes little during the course of the school year, and exerts a powerful, if subtle, influence on thought and behavior (e.g., Anderson and Evertson 1978; Buckley and Cooper 1978; Shultz and Florio 1979; Tickunoff and Ward 1978).

Functions of planning. Research on the functions of teacher planning has suggested that there are almost as many reasons to plan as there are types of planning. In the study by Clark and Yinger (1979) mentioned earlier, the teachers' written responses to a question about why they plan fell into three clusters: (1) planning to meet immediate personal needs (e.g., to reduce uncertainty and anxiety; to find a sense of direction, confidence, and security), (2) planning as a means to instructional ends (e.g., to learn the material, to collect and organize materials, to organize time and activity flow), and (3) planning for direct use during instruction (e.g., to organize students, to get an activity started, to aid memory, to provide a framework for instruction and evaluation).

An ethnographic study of the planning of 12 elementary teachers by McCutcheon (1980) also confirmed that some teachers plan in order to meet the administrative requirement that they regularly turn in plans to the school principal. These teachers also indicated that special plans were necessary for use by substitute teachers in the event of absence of the regular teacher. These plans for substitute teachers were special both because they included a great deal of background information about how the particular classroom and school operated and because the regular teachers tended to reserve the teaching of what they judged to be important material for themselves and to plan filler or drill activities for substitute teachers. (Incidentally, I have long believed that a great deal could be learned about teacher thinking and teacher planning from the vantage point of substitute teachers. I hope that someday someone will do that study.)

Planning and the content of instruction. The most obvious function of teacher planning in American schools is to transform and modify curricula to fit the unique circu stances of each teaching situation. In one of the only studies of yearly planning to date, Clark and Elmore (1981) asked a teacher of second grade to think aloud while doing her yearly planning for mathematics, science, and writing. The primary resources used in yearly planning were curricular materials (especially teacher's guides), the teacher's memory of classroom interaction during the previous year, and the calendar for the coming school year. The process of yearly planning, typically done during summer months, consisted of the teacher reviewing the curricular materials that she would use in the coming year, rearranging the sequence of topics within curricula, and adding and deleting content to be taught. A broad outline of content, and, to a lesser extent, of how it would be taught, emerged from mental review of the events of the past year, combined with adjustment of the planned sequence and pace of teaching to accommodate new materials and ideas consistent with the teacher's philosophy of instruction.

Through review of the past year, reflection on how things went, and modification of the content, sequence, and planned pace of instruction, the yearly planning process served to integrate the teacher's experiences with materials, establishing a sense of ownership and control of content (Ben-Peretz 1975). Yearly planning sessions satisfied this teacher that she had the resources to provide conditions for learning at least equal to those she provided during the previous year. Yearly planning decreased the unpredictability and uncertainty that attend every teaching situation.

The Clark-Elmore study of yearly planning supported the idea that published curricular materials have a powerful influence on the content and process of teaching. In a series of studies of teacher planning for sixth grade science instruction, Smith and Sendelbach (1979) pursued this idea at the level of unit planning. Working with the SCIS science curriculum, Smith and Sendelbach compared explicit directions for a unit of instruction provided in the teacher's manual with four teachers' translations of those directions into plans and finally with the actual classroom behavior of one of the teachers while teaching the unit.

Observation of the four teachers during planning sessions, combined with analysis of think-aloud and stimulated-recall interview data, revealed that the principal product of a unit planning session was a mental picture of the unit, the sequence of activities within it, and students' probable responses. These mental plans were supplemented and cued by sketchy notes and lists of important points that the teachers wanted to remember. Smith and Sendelbach characterized the process of activating a unit plan as one of reconstructing the plan from memory, rather than of carefully following directions provided in a teacher's guide.

Smith and Sendelbach were critical of the loose coupling between curriculum and instruction because of the potential that they saw for distortions or significant omissions in the content of science instruction. From their classroom observation of one experienced teacher implementing her unit plan, these researchers concluded that the quality of instruction was degraded somewhat by both planned and unintended deviations from the SCIS curriculum. They attributed these deviations to the teacher's limited subject-matter knowledge, difficulty in finding information in the teacher's guide, and the presence of inherently complex and confusing concepts. The researchers suggested that the phenomenon of heavy dependence on teacher's guides in unit planning provides an opportunity to improve the quality of instruction by revising these guides to be more clear, more comprehensive, and more prescriptive.

Three points are of special interest in these findings concerning the types and functions of teacher planning. First, it is surprising that so few studies have attempted to describe teacher planning as it occurs naturally in all its variety. Virtually all but two or three studies of teacher planning have focused on a single type of planning. I believe that we could benefit from more studies that describe the full range of kinds of planning that teachers do during the school year and the interrelationships between these kinds of planning. Second, the modest-to-insignificant role of lesson planning for experienced teachers is interesting. Lesson planning is the one type of planning addressed directly in all teacher preparation programs. Yet it is rarely claimed as important in the repertoire of experienced teachers. This anomaly suggests that some of our teacher preparation practices bow more to the task demands of the university than to those of the teaching profession. Finally, I believe that the functions of teacher planning that are not directly and exclusively concerned with a particular instructional episode have been slighted. Researchers and teacher educators should think more broadly about what teachers accomplish in planning and avoid narrow comparisons of what was planned with what was taught as the sole criterion for evaluation.

What Models Describe Teacher Planning?

The second major question asked by researchers on teacher planning is what models describe the planning process. The logic of industrial production produced the most widely prescribed model for teacher planning, as first proposed by Ralph Tyler in 1950. This linear model consists of four steps: (1) specify objectives, (2) select learning activities, (3) organize learning activities, and (4) specify evaluation procedures. This linear model has been recommended for use at all levels of educational planning, and thousands of educators have been trained in its use. It was not until 1970 that researchers began to examine directly the planning processes in use by teachers and to compare that being practiced with that being prescribed.

Taylor (1970) conducted a study of teacher planning in British secondary schools. The study purported to examine how teachers plan course syllabi. Using group discussions with teachers, analyses of syllabi, and a questionnaire administered to 261 teachers of English, science, and geography, Taylor came to the following general conclusions: The most common theme found across all of the modes of data collection was the prominence of the pupil, especially pupil needs, abilities, and interests. Following these, in order of importance, were subject matter, goals, and teaching methods. In planning for courses of study, evaluation emerged as being of little importance, as did the relation between one's own courses and the curriculum as a whole. Taylor concluded that most course planning is unsystematic and general in nature, and that most teachers appear far from certain about what planning requires.

Through teacher ratings of the importance of various issues in curriculum planning and a factor analysis of their responses, Taylor identified four primary factors of interest to his sample of teachers. The results indicated that, when planning, the teachers tended to consider in order of importance: (1) factors associated with the teaching context (e.g., materials and resources); (2) pupil interests; (3) aims and purposes of teaching; and (4) evaluation considerations. Rather than beginning with purposes and objectives and moving to a description of learning experiences necessary to achieve the objectives as linear planning theorists propose, Taylor found that these teachers began with the context of teaching, next considered learning situations likely to interest and involve their pupils, and, only after this, considered the purposes their teaching would serve. Another difference between Taylor's data and the Tyler model was that criteria and procedures for evaluating the effectiveness of courses of teaching were issues of only minor importance. These findings led Taylor to conclude that curriculum planning should begin with the content to be taught and accompanying important contextual considerations (e.g., time, sequencing, resources). This should be followed by considerations of pupils' interests and attitudes, aims and purposes of the course, learning situations to be created, the philosophy of the course, criteria for judging the course, the degree of pupil interest aroused by the course, and finally, evaluation of the course.

Zahorik (1975) continued this line of inquiry by examining the use of behavioral objectives and the "separate ends-means" model as well as the "integrated ends-means model" proposed by MacDonald (1965) and Eisner (1967). He asked 194 teachers to list in writing the decisions they make before teaching and the order in which they make them. He classified these decisions into the following categories: objectives, content, activities, materials, diagnosis, evaluation, instruction, and organization. He found that the kind of decision made by the most teachers concerned pupil activities (81%). The decision most frequently made first was content (51%), followed by learning objectives (28%).

Zahorik concluded from this study that teachers' planning decisions do not always follow linearly from a specification of objectives, and that, in fact, objectives are not a particularly important planning decision in terms of frequency. He also argued, however, that the integrated ends-means model does not appear to be a functioning reality because of the relatively few teachers (only 3%) who reported beginning their planning by making decisions about activities.

More recently, researchers have turned their attention to describing teacher planning by observing and audiotaping teachers thinking aloud during planning sessions. Peterson, Marx, and Clark (1978) examined planning in a laboratory situation as 12 teachers prepared to teach a new instructional unit to groups of junior high school students with whom they had had no previous contact. These units were taught to three groups of eight students on three different days. During their planning periods, teachers were instructed to think aloud; their statements were later coded into planning categories including objectives, materials, subject matter, and instructional process. The primary findings of this study were (1) that teachers spent the largest proportion of their planning time dealing with content to be taught; (2) that. after subject matter, teachers concentrated their planning efforts on instructional processes (strategies and activities); and (3) that the smallest proportion of planning time was spent on objectives. These findings were consistent with those of Zahorik (1975) and Goodlad et al. (1970). Also, the third finding recalled results reported by Joyce and Harootunian (1964) and by Popham and Baker (1970).

Task demands on the teachers should be taken into account in interpreting these results. The researchers provided the teachers with unfamiliar materials from which to teach and limited preparation time to 90 minutes immediately preceeding teaching on each day of the study. Since the teachers did not know their students in advance, it follows that their planning would emphasize content and instructional processes. Finally, the researcher gave the teachers a list of six general teaching goals, expressed in terms of content coverage, process goals, and cognitive and attitudinal outcomes. Under these circumstances, it is not surprising that the teachers devoted little planning time to composing more specific objectives and used the greater part of the time for studying the content and deciding how to teach it.

A study by Morine-Dershimer and Vallance (1976) in a classroom setting found results consistent with those of Peterson, Marx, and Clark. Morine-Dershimer and Vallance collected written plans for two experimenter-prescribed lessons (one in mathematics and one in reading) taught by 20 teachers of second and fifth grades in their own classrooms to a small group of their students. Teacher plans were described by the researchers in terms of (1) specificity of written plans, (2) general format of plans, (3) statement of goals, (4) source of goal statements, (5) attention to pupil background and preparation, (6) identification of evaluation procedures, and (7) indication of possible alternative procedures. In this study, teachers tended to be fairly specific and use outlines in their plans. Their written plans reflected little attention to behavioral goals, diagnosis of student needs, evaluation procedures, and alternative courses of action. However, the teachers reported that writing down plans for researcher-prescribed lessons was not typical, and observations of their teaching behavior revealed that much of what the teachers planned was not reflected in their written outlines (Morine-Dershimer 1979).

The Yinger model. In his five-month field study of one teacher, Yinger (1977) drew on his observations, interview data, and think-aloud protocols to create a theoretical model of the process of teacher planning. The following is a brief description of the model.

> Three stages of planning were represented in the planning model. The first stage, problem finding, was portrayed as a discovery cycle where the teacher's goal conceptions, her knowledge and experience, her notion of the planning dilemma, and the materials available for planning interact to produce an initial problem conception worthy of further exploration. The second stage in the planning process was problem formulation and solution. The mechanism proposed for carrying out this process was the "design cycle." In this cycle, problem solving was characterized as a design process involving progressive elaboration of plans over time. Elaboration, investigation, and adaptation were proposed as phases through which plans were formulated. The third stage of the planning model involved implementation of the plan, its evaluation, and its eventual routinization. This stage emphasized the contribution of evaluation and routinization to the teacher's repertoire of knowledge and experience which in turn play a major role in future planning deliberations. (Clark and Yinger 1977, p. 285)

One of the most significant contributions of Yinger's view of the planning process is that his model was cyclical in two senses. Internally, the Yinger model postulated a recursive design cycle similar to the processes hypothesized to go on in the work of architects, physicians, artists, designers, and other professionals. Externally, the Yinger model acknowledged that schooling is not a series of unrelated planning-teaching episodes, but that each planning event draws from prior planning and teaching experiences and that each teaching event feeds future planning and teaching processes. The cycle is a continuous, year-long process, in which the boundaries between planning, teaching, and reflection are indistinct.

A later study by Clark and Yinger (1979) involved asking five teachers to devise their own original, two-week unit on writing. The teachers kept journals documenting their plans and their thinking about planning during a three-week period and were interviewed twice each week. The journal keeping and interviews continued, supplemented by observations during the two-week period when the plans were implemented

Analysis supported the idea that unit planning was not a linear process moving from objectives through design of activities to meet objectives. Rather, it was a cyclical process, typically beginning with a general idea and moving through phases of successive elaboration. Some teachers spent a great deal of time and energy at the problem-finding stage, generating topics or ideas for their unit. The search process typical of this stage was distinctly different from the elaboration and refinement of the idea that took place in the subsequent problem formulation/solution stage. These data are consistent with the planning-process model developed earlier by Yinger (1977).

Individual differences in use of the model. Two of the unit plans consisted of a short problem-finding stage, brief unit planning, and considerable reliance on trying out activities in the classroom. This approach to planning was called "incremental planning" and described teachers who employed a series of short planning steps, relying heavily on day-to-day information from the classroom. The three remaining unit plans were characterized as products of "comprehensive planning," in which the teachers developed thoroughly specified frameworks for action. Comprehensive planning involved more attention to the unit as a whole and more time and energy invested in specifying plans as completely as possible before beginning to teach. Both approaches to unit planning seemed to work well for the teachers who used them. Incremental planning saved time and energy while helping teachers stay in touch with students' changing needs. Comprehensive planning provided a complete and dependable guide for teacher-student interaction for the course of a unit, reducing uncertainty and increasing the probability of achieving objectives.

A final gloss on the models-of-planning issue comes from a University of Alberta doctoral dissertation by McLeod (1981). She approached the question of learning objectives in planning in a new way by asking not whether learning objectives are the starting point for planning but by asking *when* teachers think about those objectives. Working with 17 kindergarten teachers, McLeod did a stimulated-recall interview with each teacher, using a videotape of a 20- to 30-minute classroom activity taught earlier that same day. The purpose of the interviews was to determine when intended learning outcomes were formulated in terms of four stages: *preactive stage 1* (before planning activities or selecting materials); *preactive stage 2* (after planning but before teaching); *interactive stage 3* (during the act of teaching); and *postactive stage 4* (during reflection after a teaching episode) (after Pylypiw 1974). The interviews also revealed the distribution of types of intended learning outcomes (cognitive, social, and psychomotor).

Averaging the responses across the 17 teachers, McLeod found that the largest percentage of intended learning outcomes was identified during the interactive stage (45.8%). This was followed by preactive stage 1 (26.5%), preactive stage 2 (19.5%), and the postactive stage (8.2%). The data also indicated that 57.7% of the intended learning outcomes were categorized as cognitive; 35% as social or affective; and 7.2% as psychomotor or perceptual. Interestingly, the social/affective intended learning outcomes were primarily identified during the interactive stage, while cognitive outcomes predominated in the preactive and postactive stages.

The McLeod study may be criticized on the grounds that excessive weight may have been placed on the stimulated-recall interviews. These data could have been supplemented to good effect by observations and by teachers thinking aloud during the preactive stages. But this research does much to broaden the concept of goals, objectives or intended learning outcomes, and their roles in planning and teaching. Earlier research tended to dismiss learning objectives as a rare and therefore unimportant element in teacher planning, even characterizing teachers as interested only in activities rather than in outcomes. McLeod's study suggests that teachers can and do consider and act to support both specific and general learning outcomes for their students, and that it is hazardous to study the process of teacher planning in isolation from interactive teaching and postactive reflection.

Teacher Planning and Classroom Interaction

The third and final question addressed in this review has to do with the link between teacher planning and action in the classroom. Studies mentioned earlier have demonstrated that the content of instruction and the sequence of topics are influenced by teacher planning (e.g., Smith and Sendelbach 1979; Clark and Elmore 1981). Now we turn to a few of the studies that examine how teachers' plans influence what happens in the classroom.

Zahorik (1970) compared the effects of structured planning and the absence of structured planning on teachers' classroom behavior. He provided six of 12 teachers with a partial lesson plan containing behavioral objectives and a detailed outline of content to be covered two weeks later. He requested the remaining six teachers to reserve an hour of instructional time to carry out a task for the researchers, not telling them that they would be asked to teach a lesson on credit cards until just before the appointed time. Zahorik analyzed recorded protocols of the 12 lessons focusing on "teacher behavior that is sensitive to students" (p. 144). He defined this behavior as "verbal acts of the teacher that permit, encourage, and develop pupils' ideas, thoughts, and actions" (p. 144). In comparing the protocols of the planners and nonplanners, Zahorik judged that teachers who received plans in advance exhibited less honest or authentic use of pupils' ideas during the lesson. He concluded from this that the typical planning model—goals, activities and their organization, and evaluation—results in insensitivity to pupils on the part of the teacher.

Unfortunately, Zahorik did not determine the degree to which the teachers who received the lesson plans in advance actually planned or elaborated the lesson. A competing explanation for Zahorik's findings is that the teachers who had no advance warning about what they were to teach were forced by the demands of the task to concentrate on students' ideas and experiences, while those teachers who knew the topic of instruction two weeks prior to teaching were influenced to focus on content rather than students.

Peterson, Marx, and Clark (1978) conducted a laboratory study of teacher planning, teaching, and student achievement. Twelve experienced junior high school teachers were given social studies materials dealing with life in a small French community along with a list of desired cognitive and affective objectives. The teachers were given a 90-minute period to think aloud while they planned a three-hour instructional unit. After planning, the teachers were videotaped while teaching groups of eight junior high school students. At the end of the teaching day, the teachers were interviewed using a stimulated-recall process in which they viewed videotaped segments of their own teaching and responded to a series of questions about their thought processes while teaching. The students completed achievement tests and an attitude inventory immediately after class. Each teacher repeated this process on three days with three different groups of students.

A number of positive relationships between the focus of the teachers' planning statements and their classroom behavior emerged. For all teachers, planning on the first day of teaching was heavily weighted toward content to be covered. However, the focus of their planning shifted on days two and three, with planning for instructional processes becoming more prominent. The proportion of planning statements dealing with the learner was positively related to teacher behaviors classified as "group focused." The proportion of planning statements dealing with content was positively and significantly correlated with teacher behavior coded as "subject matter focused." These findings suggest that teacher planning is most related to the general focus or tone of interactive teaching, rather than to the specific details of verbal behavior. They also suggest that the nature of the work done during the preactive planning period changes with situation-specific teaching experiences. As task demands on the teacher change, so does the nature of appropriate preparation.

Carnahan (1980) studied the planning and subsequent behavior of nine fifth grade teachers teaching the same two-week mathematics unit. The quality of the teachers' written plans was determined by rating plans that focused on large groups as low in quality and plans that focused on individuals or small groups as high in quality. (This criterion was chosen because the curricular materials that the teachers were using incorporated a similar bias.) Classroom observers rated instruction for clarity, use of motivation strategies, and student engagement. Carnahan found no statistically significant relationship between his ratings of plan quality and the ratings of teaching quality. However, he did find a significant positive correlation between the total percentage of written planning statements about small groups or individuals and the teachers' observed use of small groups in the classroom. This and other findings in Carnahan's report indicated that the main relationship between written plans and subsequent classroom interaction lies in the organization and structuring of teaching rather than in specific verbal behavior. During interactive teaching, the responses of students are unpredictable; therefore, verbal dialogue is a poor focus for teacher planning.

The influence of planning on classroom processes in preschool teaching seems somewhat different from that observed in higher grades. Hill, Yinger, and Robbins (1981) studied the planning of six teachers who constituted the staff of a university developmental preschool. During a 10-week period, the researchers observed the teachers' weekly group planning sessions, staff meetings, conferences with student teachers, selection of materials from the storeroom, and arrangement of classroom environments. They also interviewed the teachers about their planning processes and copied planning documents and records.

Hill, Yinger, and Robbins found that much of the teachers' planning centered on selecting and arranging manipulable materials. The school storeroom was an important source of ideas for learning activities; once appropriate materials were identified, the planning process focused on how these materials were to be arranged in the classroom and on how the transitions into and out of these activities were to be managed. The teachers were observed to spend three or more hours per week arranging their classrooms. When an activity did not go well, the first improvement strategy used by these teachers was to rearrange the physical environment. Because teaching in this setting was so heavily dependent on the materials selected and arranged by the teachers, the nature of the children's learning opportunities were heavily influenced by teacher planning. In turn, the nature of the planning process was influenced by the demands of teaching in this setting.

These studies, taken together, suggest that teacher planning does influence opportunity to learn, content coverage, grouping for instruction, and the general focus of classroom processes. They also highlight the fact that the finer details of classroom teaching (e.g., specific verbal behavior) are unpredictable and therefore not planned. Planning shapes the broad outlines of what is possible or likely to occur while teaching and is used to manage transitions from one activity to another. But once interactive teaching begins, the teacher's plan moves to the background and interactive decision making becomes more important.

Conclusions

In conclusion, as I reflect on what research on teacher planning tells us about the types and functions of planning, models of the process, and the connections between planning and teaching, I come up with five recommendations concerning essential knowledge for beginning educators:

1. Teacher planning is a large, important, demanding, and usually invisible and solitary part of professional teaching. Institutions and colleges should provide more support for teacher planning.
2. Teachers must engage in several types of teacher planning during the school year. These types of planning are not independent; rather, they are nested and interactive. As teacher educators, we ought to ask ourselves where and how the various kinds of teacher planning are addressed in our teacher preparation programs.
3. Curricula are inevitably transformed in the planning process by additions, deletions, misunderstandings, and so forth. The actual, taught curriculum is created largely via teacher planning. We need to begin thinking of curriculum as consisting of both published materials and the teacher's interpreation and enactment of them.
4. There does not seem to be a best way to plan. Experienced teachers' planning has been described by a variety of models, and the model or style in use varies with the task, time available, and other circumstances. In teacher preparation, perhaps these models or styles of planning could be used as heuristic first approximations of how to plan, much as the models of teaching by Joyce and Weil (1972) have been used. As prospective teachers gain experience, they could be encouraged and assisted to develop approaches to planning that fit their situations.
5. Teacher planning reduces but does not eliminate uncertainty about how instruction will take place. Interactive teaching is a complex, volatile social process that includes surprises as a matter of course. I believe that it will help beginning educators to think of their plans as flexible frameworks for action, as devices for getting started in the right direction, and as something to depart from or elaborate on, rather than as rigid scripts.

The knowledge produced by research on teacher planning consists of three closely interrelated parts: information about what teacher thinking consists of (the forms that it takes, the functions that it performs, and the range of individual differences in teacher thinking); a language of verbal labels for concepts and phenomena important in teacher thinking that we can use to communicate about this "invisible world"; and methods of inquiry for describing, analyzing, and understanding the mental lives of teachers. These methods of inquiry were originally developed as research tools but also hold great promise as means for teacher education and professional development.

I believe that the information, language, and methods of inquiry developed through research on teacher planning can be integrated into existing programs of teacher preparation and professional development. The aim is not to overthrow or supplant present practice but to provide the tools for more complete understanding of why schooling is as it is and to build a firmer foundation for planned change.

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The Dilemma of Determining Essential Planning and Decision-Making Skills for Beginning Educators

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As often happens when one accepts an invitation to address a certain topic, my reflection after the acceptance resulted in a change in perspective. Originally, I had assumed that I could draw inferences about essential planning and decision-making skills from available research literature. This, unfortunately, proved not to be the case. Although I cannot claim to have read in detail every study dealing with the topic, I can claim a broad familiarity with the literature. This familiarity, partly influenced by the inconsistency of both findings and methodological approaches and partly by my own predilections regarding research into practice, caused me to take a more cautious approach to the topic than I had intended.

The identification of essential skills in any personal or professional activity is problematic in both intellectual and practical ways. One way to approach the task is to assume that certain ends in view are desirable and, from that point, acknowledge the importance of specific antecedents to the accomplishment of those purposes. This rationalistic approach is seductive in that it limits one's options. It is also potentially dangerous for the same reason: It places limitations on selection possibilities. Another way to approach defining what is essential is to publicly specify a set of values regarding the issues in question and then to derive from either funded knowledge or logical speculation what will be necessary to accomplish those essentials. A third way to approach the problem is to look at the demands of a setting (as opposed to the ends-means or values-means paradigms) and make considered judgments about what must take place for those demands to be met.

Consider, for example, this proposition: The research on classroom teaching has noted a correlation between aggregates of teachers' management behaviors and students' time on task. Further, time on task has been correlated with higher-than-predicted cognitive gain by students. If one accepts as a valued end the cognitive gains of students as measured by standardized achievement scores, one can say that one essential for beginning teachers is the demonstration of certain classroom-management behaviors. If, however, teachers' management behaviors do not fit with one's set of values about desired characteristics of a teaching and learning community, then what is really essential is recognition on the part of the beginning teacher that there are many ways of managing and organizing a classroom and that the research-derived desirable behaviors represent only part of the array—and not necessarily the best part. Last, one might examine particular educational settings and find that certain classroom-management behaviors simply do not fit in some manner. Thus, one might conclude that the essential skill is to formulate a set of behaviors that do fit using certain characteristics of the setting as guides.

My purpose here is to suggest, from a research perspective, what planning and decision-making skills are essential to a new teacher's repertoire. This is a difficult task partly because of the variety of ways it might be attacked and partly because of the relatively embryonic state of research in the field. Studies of teacher planning and decision making are few. Moreover, they are characterized by differing conceptualizations and methodologies. In sum, there is no body of research knowledge robust enough to support use of the ends-means paradigm or comprehensive enough to suggest context requirements.

What we do have, each of us, is a set of beliefs about what is essential. My own set is a mix-and-match amalgam derived from my understanding of research, my knowledge of classrooms and teachers in action, and my values about learning communities. The introduction of values or beliefs will cause some to reject the ideas put forth here. Such rejection, more than likely, would be a consequence of the assertion sometimes made that science (e.g., research) is or should be value free. I have never believed that research is value free. Even in the most descriptive of studies, one must focus on something, and decisions regarding what will and will not be recorded are value laden. In like fashion, the decision to move from the discovery of a correlation (e.g., the relation between certain classroom-management behaviors and pupil time on task) to an experiment designed to introduce the management behaviors in classrooms demonstrates what is valued—in this instance, probably pupil time on task.

Planning, Decision Making and Requirements of Teaching

Too often, we speak of teachers and teaching in the abstract. We make general comments about both as though

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Figure 1

Teacher Planning and Decision Making and Four Requirements of Teaching: A Scheme for Analysis

	Curriculum Planning and Implementation	Instruction	Grouping of Students	Evaluation
Proactive stage				
Interactive stage				
Reflective stage				

there were no people embedded in the role or in the process. Yet, aphoristic slogans simply cannot do justice to these topics. A teacher is more than a disciplinarian, more than a purveyor of information, more than a person charged with crowd control. Likewise, teaching is more than transmitting basic skills, more than a set of behaviors. As Maxine Greene (1983) asserted,

> My interest is in teaching; and teaching, for me, has to do with releasing people to learn how to learn. It has to do with possibilities and personal discoveries, with events in experience, with the making of connections, with the opening of doors. I want to see…teachers being enabled to create the kinds of situations that provoke students to reach beyond themselves—indeed, to become so concerned about posing questions and seeking answers and working things out that they cannot but act on their own initiatives—and in time begin teaching themselves. (p. 86)

What a vast difference between the vision of teaching in this passage and the bland euphemisms heard on back-to-school night or the microprescriptions for teacher behavior that fill the research reports my colleagues and I share. Not that each of these ways of treating teachers and teaching does not have value in certain situations. The euphemisms are often catchy phrases that focus attention on matters of concern. The teacher-behavior dicta, when considered in a broad picture of teaching, can remind teachers and others that what seem to be commonsense actions have been shown to be predictive of valued pupil outcomes. (It is often forgotten that almost all of what the researchers specify as effective teaching was invented by teachers and only discovered by researchers.)

In struggling to come to grips with essential skills for beginning educators, it may help to think of the requirements of teaching. By requirements, I mean the conventions of teaching, those activities that may be commonly agreed upon as present in all or almost all teaching situations, rather than particularistic, situation-specific demands made upon teachers. An example of the two elements in this distinction is contained in the statement, "Although all teachers plan for instruction, only some teachers plan for individualized instruction."

Based upon observation of practice and my own understanding of teaching activity, I have selected four basic requirements of teaching for inclusion here: curriculum planning and implementation, instruction, grouping of students, and evaluation. Each of these four requirements of teaching may be considered from at lease three vantage points. One is as a planning activity, wherein the teacher makes considered decisions about what might occur in the classroom. The second is as the implementation of a plan, wherein the teacher, together with students, acts out the plan in a learning setting. The third is as a reflection phase, in which the teacher figuratively plays back the plan and the implementation in such a way as to make judgments about such issues as the success or failure of the instructional sequence, the degree of sustained interest on the part of students, the next steps in the curricular segment, and so forth.

This way of thinking about teacher planning and decision making, then, leads to a conception that accounts for proactive, interactive, and reflective behavior. It promotes a way of thinking about teaching that gives deliberate attention to the relation between teacher thought and teaching activity. It also acknowledges that there is considerably more to teaching than standing before a group of students. Using the four requirements of teaching I have noted, this conception of planning and decision making may be represented as in Figure 1.

My views of teaching and schooling suggest to me that for each of the four requirements of teaching, the teacher must demonstrate planning and/or decision-making skills. For example, in curriculum planning, the teacher must make decisions about content, sequence, instructional materials, intentions, and so forth. It is logical that the teacher who can plan coherently and efficiently, according to some reasoned conception of the curriculum and the students, is potentially more effective than the teacher who has no mental script of what classroom life should be like. Related to this is the major distinction between long-term and short-term curriculum planning. Although we all are aware of the occasional successes that burst forth like skyrockets now and then without our conscious preparation, my conception of curriculum planning demands a sense of not just today's or tomorrow's learning activity but a picture of where an activity fits into plans for a month, a year, or several years of learning.

Another set of examples of the utility of such a scheme for thinking about planning and decision making emerges from considering the intersection of instruction and implementation. Here the focus is not on planning but on decision making. The teacher moves through interactions with students and others and, one hopes, adapts plans to circumstances. This suggests that the teacher decides to adhere to, or adapt, or even abandon a plan for instruction because of careful, if immediate, consideration of appropriate information in the learning situation. Such information could come in the form of quizzical looks from students, a series of related student questions about content, a more dramatic event such as an overturned paint jar or an ill student, or a faintly discerned air of boredom or passivity. The issue here regarding decision making is that the teacher's decisions are made on the spot as well as before and after instruction.

For the third level of planning and decision making, consider the intersection of the evaluation requirement of teaching and the reflective level of planning and decision making. Ideally, when a teacher reflects upon the evaluative aspects of teaching, he or she gives conscious attention to both the degree to which students are meeting curricular and instructional expectations and the degree to which the program is adequate to help students meet those expectations.

One sees, then, multiple possibilities for planning and decision making by teachers. These possibilities are tied to at least two interacting phenomena: substantive or professional practice and preactive, implementation, or reflective levels of deliberation.

Observation of Practice

What does our observation of practice tell us about the realization of these planning and decision-making possibilities? My colleagues and I (Griffin et al. 1983) completed a large scale, multimethod, multisite semester-long study of student teaching. In the course of that study, we sought to describe student teaching in terms of individual participants, the interactions between and among participants (student teachers, cooperating teachers, and university supervisors), and the nature and influence of the contexts in which student teaching took place. We developed a large data base consisting of information about the personal and professional characteristics of participants, formal and informal properties of the university and public school contexts, teaching, supervision and evaluation of student teachers, and outcomes of the experience. We drew a set of conclusions about student teaching as a professional education intervention and, given the nature and magnitude of our data base, can now examine our information in light of other questions, such as teacher planning and decision making.

Data from our study suggest these conclusions:

1. Teacher candidates are preoccupied with planning lessons. This tendency is reinforced explicitly and implicitly by cooperating teachers, university supervisors, and the protocols of teacher education programs.
2. Teacher candidates are relatively unconcerned and uninformed about how to plan sequences of instruction such as would be involved in providing articulated learning opportunities for a period as long as a school year or as short as a two- or three-week unit.
3. Teacher candidates receive minimal (if any) assistance in determining which data sources are available for or appropriate to making instructional decisions, either before or during ongoing instruction.
4. The issue of evaluation (as opposed to grading of individual efforts by specific students in a particular classroom) is almost totally absent from our data. Evaluation as a means of determining program effectiveness simply did not surface during student teaching for members of our sample.
5. Student teachers had almost no opportunities to group or regroup students for instruction and consequently received little or no practice in diagnosis and prescription in terms of matching needs of students with instructional activities.
6. Cooperating teachers are reluctant to give student teachers opportunities to take full charge of instruction, even if only for a few consecutive days.
7. Student teachers make few curricular decisions on their own. Most often, they follow the lead of cooperating teachers who provide them with the basic decisions, expecting the students to translate those decisions into instruction.
8. The primary area of concern for both cooperating teachers and student teachers is classroom management. Although one might assume that this preoccupation would lead to consideration of a set of options for creating a well-organized and effectively managed classroom, in our study there appeared to be two differing views. Either the student teacher was told to "find your own best way to achieve order" or the cooperating teacher mandated certain management behaviors, which

the student teachers emulated. I know of no instance in our study in which a planning process (that is, a consideration of alternatives and a subsequent data-based decision to move in one manner over another) was reflected in a journal entry or in an audio-recorded supervision conference. (To be fair, we must admit that such decision making may have taken place but escaped our notice.)

These conclusions form only a small set of those developed from analysis of our data. A much larger group, like the ones I've noted here, could be advanced. This list does, however, point to several potential problems in terms of the relation of student teaching to essential planning and decision-making skills for beginning educators. If prospective teachers are denied opportunities to plan curricula, they will probably enter the workplace with underdeveloped skills, no matter which orientation, empirical or philosophical, is used to define "essential." If examination of the culmination of a professional sequence does not provide evidence that teachers-to-be are concerned about the decisions they will make and how best to make them, they may continue as reactive rather than proactive educators. If persons preparing to be teachers grow accustomed during student teaching to assuming that there is one way to go about instruction or evaluation or grouping or classroom management, it is unlikely that they will be able to adjust to different classroom situations and social contexts.

There is another part of this puzzle, however. That is the context requirements placed upon new teachers in terms of planning and decision making. Remember that one way we might determine what is essential is to examine the requirements of the contexts, schools, and school systems. In another study, we are concerned about the apparent lack of impact of teacher change and teacher-effectiveness research on system, school, and classroom practices (Griffin et al. 1983). As part of that inquiry, we have spent many hours in classrooms over six months. In the course of that immersion, we are becoming more certain that teacher planning and decision making is abrogated by planning and decision making that takes place at some distance, temporally and ideologically, from the classrooms. This is particularly true for reading and mathematics in elementary schools, but, given the enormous amount of time now devoted to those subjects, the conclusion would probably hold for the school day generally.

It has never been surprising that textbook domination of instruction is a distinct possibility in some settings and a sharp reality in others. Our observations suggest that even locally produced and implemented curricula may be as confining, in terms of teacher decision making, as the most programmed commercial text. Usually, some teachers are involved in planning for instruction as part of a curriculum committee but larger numbers of teachers are expected to follow the plan laid down by the first group. Our clinical judgment is that it is a rare teacher who adapts in any significant fashion the curriculum as presented and an even rarer teacher who tosses it out as a consequence of reasoned judgment.

These observations, like those regarding student teaching, mitigate against conceiving of the teacher as a planner or rational decision maker. On the one hand, opportunities to learn and practice such behaviors do not exist in preparation programs to any discernible degree, and, on the other, system constraints are placed upon teachers once they are in service. (Obviously, these comments are generalizations; there may be many exceptions in specific programs and specific teachers.) I am convinced that this description is more accurate than the multifaceted, complex picture of teaching painted by Greene in the earlier passage.

Research Findings Regarding Teacher Planning and Decision Making

I agree with Smith (1980) who wrote in his *A Design for a School of Pedagogy,*

> . . . knowledge derived from research is to be taken cautiously, but not less so than craft knowledge. And either one is preferable, even when the evidence favoring them is fragile, to fictions and nostrums. . . . As a profession becomes aware of and respects its knowledge and techniques, those who espouse fictions, wholesale remedies, and utopian scenarios lose their audience. (p. 55-6)

But, I wonder, have we developed a sensibility that attaches too much importance to too little research evidence? As Smith implied, research-derived knowledge should be examined carefully; the potential user should monitor use of that knowledge systematically.

I will now present a set of research findings regarding teacher planning and decision making in the belief that we must acknowledge the relatively embryonic state of the field and the idiosyncratic nature of the methodologies used by my research colleagues. In other words, I present these findings in the hope that they will provoke thought and, perhaps, even some considered activity—not because I believe they should be adopted as guidelines for teacher preparation.

In a comprehensive review of research on teacher judgment, planning, and decision making, Shavelson (1982) noted that such research rests on two assumptions. The first is that teachers are ". . . rational professionals who, like other professionals such as physicians, make judgments and carry out decisions in an uncertain, complex environment" (p. 1). The second is ". . . that teachers' behaviors are guided by their thoughts, judgments and decisions" (p. 2). These assumptions, taken together, provide justification for looking beyond observable teacher behavior to the stimuli for those behaviors.

Among the findings reported in Shavelson's review were the following:

1. McNair (1978-9) noted that teachers are primarily influenced by concern for pupils and secondarily by concern for content. This was found when teachers observed videotapes of their teaching.
2. Shavelson and Stern (1981) reported that teachers judge student ability primarily by using information about student achievement and, to a degree, information about problematic behavior.
3. Regarding diagnosis of students, Gil (1980) found that teachers lacked specific strategies for gathering information, differed among themselves (not surprisingly) in the ways they did collect and process information, and operated at a general, incomplete level of pupil diagnosis.
4. A number of researchers have concluded that teachers' plans serve as scripts that, subsequent to planning, become fairly rigid, relatively unmodified guides to classroom action (Shavelson and Stern 1981; Joyce 1978-1979; Peterson and Clark 1978; Zahorik 1970).
5. Teachers' plans, in terms of pupil grouping, are predictive of, for instance, the pace of reading instruction (Shavelson and Borko 1979).
6. Taylor (1970) argued that most teacher planning cannot be considered systematic and specific.
7. Teachers plan at the level of classroom activity more than at the level of instructional objectives or other rational-empirical dimensions of planning (Clark and Yinger 1979; Peterson et al. 1978; Smith and Sendelbach 1979; Yinger 1977; and Zahorik 1975).
8. The principal planning concern for teachers is subject matter or content as it relates to the development of classroom activity (Shavelson and Stern 1981).
9. Research findings support two dichotomous conclusions: (a) Teachers consider students in their planning early in the school year but less as they become familiar with them (Morine-Dershimer 1978; Mintz 1979); and (b) teachers seldom mention students during planning (Peterson et al. 1978). This sharp difference may arise from the methods used by different researchers.
10. Although the activity is the focus of teachers' planning, Morine-Dershimer (1978) acknowledged that teachers do include objectives in their overall planning schema. However, one must focus teachers' attention on objectives in order to verify that they include them in their plans.
11. Shavelson reported that ". . . teachers are reluctant to change their routines, even if they are not proceeding as well as expected" (p. 32).
12. Regarding teachers' decision making during instruction, the research suggests that it is not pervasive, rests on only a few options for activity, is most powerfully influenced by teachers' perceptions of student behavior, and is characterized by little critical evaluation after instruction.
13. Evertson, Emmer, Sanford, and Clements (1982) found that a brief workshop and a detailed training manual were effective in developing plans for organizing elementary classrooms at the beginning of the school year. Further, testimony from teachers suggested that the workshop and manual helped because they provided concrete, specific, and practical suggestions.
14. Yinger's (1978) detailed study of one teacher's planning thoughts and activities indicated that the topic of activities was the dominant concern, followed by classroom routines. This teacher, in contrast to the ones observed by my colleagues and me, demonstrated several levels of planning: yearly, term, unit, weekly, and daily. Yinger moved from the study of this teacher to the development of a planning process that included developmental stages of what he called problem-findings; problem formulation/solution; and implementation, evaluation, and routinization.

With the exception of the Evertson et al. (1982) study, the findings regarding teachers' proactive decision making and planning are relatively inconclusive, even though Yinger advanced to the formulation of a planning model. Also, the studies' range of intentions makes it difficult to draw firm conclusions from them as a coherent body of research. Further, most of the studies are descriptive rather than experimental, so we must be extremely cautious about promoting the maintenance of the status quo for teacher education programs.

However, if one ignores the sharp differences in researchers' methods and intentions (always a risky undertaking), a picture emerges of teachers beginning the school year concentrating planning activities on students but spending the most energy on decisions about classroom activity. Even decisions about classroom activity are made from a relatively narrow range of options. When the teacher does consider students in planning and proactive decision making, the information used is associated more with observed achievement than actual ability. This condition is more than likely a consequence of the lack of a systematic and reasoned strategy for gathering information on decision making. Once initial planning decisions are made, our profile teacher seldom deviates from the mental script that emerged from the planning. Finally, our teacher's planning decisions, at least pertaining to organization for the beginning of school, may be influenced positively by participation in a focused workshop and by using a manual of prescriptions.

So what does research tell us about essential planning and decision-making skills for the beginning educator? My considered response to that question is: not much . . . yet. Given the interest in the topic expressed by researchers around the country, I believe that a less negative response may be forthcoming. But the research orientation must shift before we can adequately come to grips with the issue. As happened in the research on teaching, I would like to see studies of planning that are descriptive in nature but that also look at what certain planning and decision-making modes are related to. As in the correlation proposition I described earlier, I would like to see planning and decision-making differences as those differences are related to other valued variables such as pupil cognitive gain, classroom climate, satisfaction with schooling, positive peer-group interactions, teachers' self-esteem, and the like. At that point, we will be able to speak of essentials as things valued. Only then, I believe, will we be able to talk about the planning and decision making that contributes to the vision of teaching advanced by Maxine Greene.

Concluding Comments

As a born-again truth seeker and reconstructed positivist, I find it difficult to end these remarks on a note of combined abject pessimism and cautious methodological optimism. So I would like to pose some broad questions, which I believe could stimulate valuable and exciting research in the field of teacher planning and decision making.

Why is it that teacher planning and decision making, evidently so important, has received so little systematic research attention? Is it possible that the research community and the teacher education community share too few opportunities for exchanging views? Is it possible that teacher educators shy away from research? Is it possible that researchers are unaware of the conventions of teacher education?

Why are long-range planning strategies and activities not more prominent in teacher education? Is it because there is too little time in the professional teacher preparation sequence? Is it because each subject matter must receive some attention, thus diminishing concern for overarching conceptions of planning? Is it because it is easier to teach the skills of planning a lesson? Is there any relation between this condition and the long-decried lack of program articulation, both vertical and horizontal, in schools?

Where should planning and decision making be addressed in the teacher preparation sequence? Should it be in college-based courses? In practice? In student teaching? In all three, according to a carefully designed, sequential, and developmental plan? Or, should it be left to the school into which the new teacher moves?

What are the most significant bodies of information for teacher planning and decision making? Knowledge of student attributes, characteristics, and potentials? Knowledge of the demands of the curriculum? Knowledge of the perceived demands of the immediate community? The larger society? If it is a combination of these, which take precedence? For what reasons? With what consequences for instruction?

To what degree do school programs allow for teacher planning and decision making? Are curriculum and instructional requirements more rigid and constraining today than in times past? If so, what are the implications for teacher preparation? Do we teach young people to fit the system or to influence it to allow more reasoned professional activity among teachers?

In terms of planning and decision making, what is the relationship between the requirements of the schools our prospective teachers enter and the professional preparation they receive? What can be done to demonstrate that the schools and the institutions that prepare teachers are like-minded about valued teaching activities? How can substantive and procedural linkages be forged to make that demonstration possible?

Given the general societal mandate for results, for products, for action that is immediate and observable, what rationale must be advanced to promote disciplined study and demonstration of the role of planning and decision making in instructional programs? What institutional barriers must be lowered or eliminated? What reconstruction of school-system norms, rewards, and regularities must take place?

Obviously, the value I place on the role of planning and proactive decision making by teachers influenced these questions. Also obviously, I believe that teacher educators, researchers, and practitioners must work together to answer them. The research and practice agenda implied by this list is formidable, requiring a shifting of priorities, a reconsideration of what is necessary, and a conception of the teacher as one who does a good deal more than meet with students. But I believe that the teacher who plans systematically and continuously, who bases decisions on carefully considered knowledge and well-reasoned values, who reflects on behavior, consequences, and possibilities, will be the teacher who will, as Greene wrote, ". . . free people to learn how to learn . . . and provoke students to reach beyond themselves."

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Classroom Organization and Management[1]

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Ten to 15 years ago, there was little systematic research on classroom management, despite the recognized importance of the field. Teachers seeking advice on how to organize and manage their classrooms had to rely on psychological theories developed outside classroom settings or on the bag-of-tricks suggestions of individual teachers. Unfortunately, many theory-based ideas proved incorrect or impractical for classroom use; experience-based advice was unsystematic and often contradictory. As a result, teachers were often left with the impression that classroom management is purely art rather than partly applied science and that "you have to find out what works best for you."

Classroom research conducted in recent years has improved this situation dramatically. Research by several teams of investigators has developed clear and detailed information about how successful teachers organize and manage their classrooms, including information about how they get off to a good start at the beginning of the year. If learned and applied systematically, the principles to be discussed here will enable teachers to establish their classrooms as effective learning environments and to prevent or successfully cope with most of the conduct problems that students present. Less classroom research exists on methods of handling students with chronic problems requiring more intensive or individualized treatment, but even in this area, more information is becoming available and there is a growing consensus about which problem-solving strategies are most practical and effective.

Prior to discussion of the principles, I will mention a few of the assumptions underlying the perspective on effective classroom organization and management taken in this paper. One is that the teacher is both the authority figure and the instructional leader in the classroom. Students may be invited to share in decision making about what and how to learn and about appropriate classroom conduct, but the teacher retains ultimate authority and responsibility. This assumption conflicts with the views of certain radical critics of education, but it matches the perceptions of most school administrators, teachers, and parents. Furthermore, recent research (Metz 1978; Nash 1976) indicates that it matches the views of students, as well.

A second basic assumption is that good classroom management implies good instruction, and vice versa. Recent research makes it clear that successful classroom management involves not merely responding effectively when problems occur but preventing problems from occurring frequently. This is accomplished primarily by good planning, curriculum pacing, and instruction that keeps students profitably engaged in appropriate academic activities. Further, instruction is involved in much of the activity that ordinarily would be described as classroom management, as when teachers provide students instruction in and opportunities to practice procedures involved in classroom routines. We may discuss classroom management apart from instruction in the formal curriculum, but in practice, these two teaching tasks are interdependent. Because successful classroom managers maximize the time that their students spend engaged in academic tasks, they also maximize students' opportunities to learn academic content. This shows up in superior performance on achievement tests (Brophy 1979; Fisher, Berliner, Filby, Marliave, Cohen, and Dishaw 1980; Good 1979; Rosenshine and Berliner 1978).

A third assumption behind the perspective taken in this paper is that optimal classroom organization and management strategies are not merely effective, but cost effective. Consequently, this paper affords little consideration to approaches that are infeasible for most teachers (e.g., token economies, extended psychotherapy) or likely to engender undesirable side effects (certain punitive approaches.)

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The Well-Organized, Well-Managed Classroom

Let us begin with the look and feel of a classroom that functions efficiently as a successful learning environment. First, it reveals organization, planning, and scheduling. The room is divided into distinct areas equipped for specific activities. Equipment that must be stored can be removed and replaced easily, and each item has its place. The physical arrangement of the room facilitates movement and minimizes crowding. Transitions between activities are accomplished efficiently following a brief signal or a few directions from the teacher. The students seem to know where they are supposed to be, what they are supposed to do, and what equipment they need (Arlin 1979).

The students appear attentive to the teacher's presentations and responsive to questions. Lessons, recitations, and other group activities move briskly, although they are structured so that parts are discernible, separated by clear transitions. When students are released to work on their own, they seem to know what to do and to settle quickly into doing it. Usually, they pursue the activity to completion without difficulty and then turn to a new, approved activity. If they do need help, they get it from the teacher or other source and quickly resume work. To an untrained observer, the classroom seems to work automatically, without much effort at management. Classroom research has established, however, that such well-functioning classrooms do not just happen. Instead, they result from teachers' consistent efforts to create, maintain, and (occasionally) restore conditions that foster effective learning.

Kounin (1970) and his colleagues first demonstrated this fact in a videotape study of two types of classrooms. The first type included the sort of smooth functioning classrooms described above. In contrast, teachers in the comparison classrooms fought to maintain order. Activities suffered from students' inattention and frequent disruptions. Transitions were lengthy and often chaotic. Much of the teachers' time was spent dealing with students' misconduct.

Kounin and his colleagues began by analyzing the videotapes from these classrooms in detail, concentrating on teachers' methods of dealing with misconduct and disruption. Given the great differences in classroom-management success displayed by these two groups of teachers, the researchers expected to see large, systematic differences in methods of dealing with misconduct. To their surprise, they found no such differences. Good classroom managers were not notably different from poor classroom managers *when responding to students' misconduct.*

Distinguishing Effective from Ineffective Managers

Fortunately, the researchers did not stop at this point. In the process of discovering that the two groups of teachers differed little in their responses to disruptive students, they noted that the teachers differed in other ways. In particular, the effective classroom managers systematically did things to minimize the frequency with which students became disruptive in the first place. Some of these preventive behaviors follow.

"Withitness." Effective managers nipped problems in the bud—before they could escalate into disruption. The teachers were able to do this because they monitored the classroom regularly, stationing themselves where they could scan all parts of the room continuously. This and related behaviors let students know that their teachers were "with it"—aware of what was happening at all times and likely to detect inappropriate behavior early and accurately.

Overlapping. Effective managers also had learned to do more than one thing at a time when necessary. When conferring with an individual pupil, for example, they continued to monitor events going on in the rest of the classroom. When teaching reading groups, they would deal with students from outside the group who came to ask questions but in ways that did not involve disrupting the readers. In general, they handled routine housekeeping tasks and met individuals' needs without disrupting ongoing activities.

Signal continuity and momentum in lessons. When teaching the whole class or a small group, effective managers were well-prepared and thus able to move through the activity briskly. There were few interruptions due to failure to bring or prepare a prop, confusion about what to do next, pauses to consult the teacher's manual, false starts, or backtracking to present information that should have been presented earlier. Minor, fleeting inattention was ignored. More serious inattention was dealt with before it could escalate into disruption but in ways that were not themselves disruptive. Thus, these teachers moved near to inattentive students, used eye contact when possible, directed a question or comment to the offenders, or cued their attention with a brief comment. They would not, however, interrupt the lesson unnecessarily by delivering extended reprimands or other overreactions that would focus everyone's attention on the inattentive students rather than on the lesson. In general, these methods were effective because students tend to be attentive (or their inattention fleeting) when they are presented with a continuous academic "signal." Problems tend to set in when students have no clear signal to attend to nor task to focus on, and problems multiply in frequency and escalate in intensity the longer the students are left without such a focus.

Group alerting and accountability in lessons. In addition to conducting smooth, briskly paced lessons that gave students a continuous signal on which to focus, effective classroom managers used presentation and questioning techniques designed to keep the group alert and accountable. These included looking around the group before calling on someone to recite, keeping the students in suspense as to who would be called on next by selecting randomly, getting around to everyone frequently, interspersing choral responses with individual responses, asking for volunteers to raise their hands, throwing out challenges by declaring that the next question would be difficult or tricky, calling on listeners to comment on or correct a response, and presenting novel or interesting material. The idea here is to keep students attentive to presentations by conveying the message that something new or exciting could happen at any time, and to keep students accountable for learning content by making them aware that they might be called at any time.

Variety and challenge in seatwork. Kounin (1970) was one of the first to recognize that students spend much (often a majority) of their classroom time working independently rather than under the direct supervision of the teacher, and that the appropriateness and interest value of the assigned work influences the quality of task engagement during these times. Ideal seatwork offers the right level of difficulty (easy enough to allow successful completion but difficult or different enough from previous work to challenge each student and, within this, enough variety to stimulate interest.

Subsequent research has supported most of Kounin's recommendations. In a correlational study at the second and third grade levels (Brophy and Evertson 1976) and in an experimental study of instruction in first grade reading groups (Anderson, Evertson, and Brophy 1979), indicators of withitness, overlapping, and smoothness of lesson pacing and transitions were associated with better group management and student learning. However, these studies did not support some of the group alerting and accountability techniques, especially the notion of being random and unpredictable in calling on students to recite. Good and Grouws (1977), in a study of fourth grade mathematics instruction, found that group alerting was positively related to student learning but accountability was related curvilinearly (teachers who used a moderate amount were more successful than those who used too much or too little). These findings are all compatible with the interpretation that group alerting and accountability devices are appropriate for occasional use within classroom-management contexts established by the apparently more fundamental and important variables of withitness, overlapping, signal continuity and momentum in lessons, and variety and appropriate challenge in seatwork. Group alerting and accountability devices do stimulate student attention in the short run, but if they have to be used too often, it is likely that the teacher is failing to implement more fundamental classroom-management strategies.

Recent research on teacher effectiveness in producing student learning gains also suggests caution about the appropriate level of challenge in seatwork. This research suggests that learning proceeds most efficiently when students enjoy high rates of success (that is, when the tasks are easy for them to do). When the teacher is present to monitor responses and provide immediate feedback (such as during recitations), success rates of at least 70% to 80% should be expected (Brophy and Evertson 1976). When students are expected to work on their own, however, success rates of 95% to 100% become necessary (Fisher et al. 1980).

This point deserves elaboration, because to many observers, a 95% success rate seems too high, suggesting a lack of challenge. Bear in mind that we are talking about independent seatwork and homework that students must work through on their own, and that these assignments demand application of a hierarchy of knowledge and skills that must be not merely learned but mastered to the point of overlearning if they are to be retained and applied to more complex material. Confusion about what to do or lack of even a single important concept or skill may frustrate students' progress and lead to both management and instructional problems for teachers. Yet, this happens frequently. Observational study suggests that, to the extent that students are given inappropriate tasks, the tasks are much more likely to be too difficult than too easy (Fisher et al. 1980; Gambrell, Wilson, and Gantt 1981; Jorgenson 1977).

Thus, although variety and other features that enhance the interest value of tasks should be considered, and although students should not be burdened with busy work that involves no challenge, teachers should ensure that the new or more difficult challenges involved in seatwork can be assimilated by students (i.e., that the students can complete the tasks with a high rate of success). This will require differentiated assignments in many classrooms, at least in certain subjects.

Getting Off to a Good Start

Kounin's (1970) work established that the key to the well-functioning classroom is maintaining a continuous, academic focus for students' attention and engagement and avoiding "down time" when students have nothing to do or are not sure about what they should do. Kounin also identified key behaviors involved in maintaining the classroom as an efficient learning environment on an everyday basis. He did not, however, deal with one question of great practical importance to teachers. How does one establish a well-managed classroom at the beginning of the year?

Brophy and Putnam (1979) and Good and Brophy (1978, 1980) suggested that the process begins with preparation and planning before the school year begins. Given the types of students and academic activities anticipated, what is the most efficient use of the available space? How should the furnishings be grouped and the equipment placed? Thought devoted to these questions when preparing the classroom may maximize the degree to which students benefit from equipment and activities (Nash 1981).

Consideration of traffic patterns in the classroom can make for smoother transitions later, and thoughtful equipment storage can minimize bottlenecks and lines.

Consideration of students' convenience in planning storage space can maximize the degree to which students handle their belongings and supplies on their own, thus minimizing the need for instructions or help from the teacher. Thought devoted to appropriate procedures and routines for handling paper flow and other daily classroom business will produce clarity about procedures that will help students know exactly what to do (and again, maximize the degree to which they handle things without help or direction from the teacher).

These speculations based on Kounin's work have been validated and elaborated in detail by Evertson, Emmer, Anderson (1980), and their colleagues at the Research and Development Center for Teacher Education at the University of Texas at Austin. In the first of a series of studies, these investigators intensively observed 28 third grade teachers, visiting their classrooms frequently during the first few weeks of school and occasionally thereafter (Anderson, Evertson, and Emmer 1980; Emmer, Evertson, and Anderson 1980). Observers took detailed notes about the rules and procedures that teachers introduced to their students, their methods of doing so, and their methods of following up when it became necessary to employ the procedures or enforce the rules. In addition, every 15 minutes during each observation, they scanned the classroom and recorded the percentage of students engaged in lessons, academic tasks, or other activities approved by the teacher. These student-engagement data and other information from the observers' descriptions of the classroom were later used to identify successful and unsuccessful classroom managers.

This study made it clear that the seemingly automatic, smooth functioning that was observable throughout most of the school year in the classrooms of successful managers resulted from a great deal of preparation and organization at the beginning of the year. Successful managers spent a great deal of classroom time in the early weeks introducing rules and procedures. Room arrangement, materials storage, and other physical aspects were prepared in advance. On the first day and throughout the first-week, special attention was given to matters of greatest concern to the students (such as information about the teacher and their classmates, review of the daily schedule, procedures for lunch and recess, where to put personal materials, access to the lavatory, when and where to get a drink). Classroom routines were introduced gradually as needed, without burdening students with too much information at one time.

Implementing classroom rules and procedures was more a matter of instruction than control, although it was important for the teachers to follow through on their stated expectations. Effective managers not only told their students what they expected them to do but personally modeled correct procedures, took time to answer questions and resolve ambiguities, and, when necessary, allowed time for practice of the procedures with feedback as needed. In short, key procedures and routines were taught to the students as more or less formal lessons, just as academic content is taught.

In addition, effective managers were thorough in following up on their expectations. They reminded students of important aspects of procedures shortly before they were to carry them out and scheduled additional instruction and practice when procedures were carried out improperly. The students were monitored carefully and not turned loose without careful direction. Consequences of appropriate and inappropriate behavior were made clearer than in other classrooms and were applied more consistently. Inappropriate behavior was stopped more quickly. In general, the more effective managers showed more of three major clusters of behavior:

Behaviors that conveyed purposefulness. Students were held accountable for completing work on time (the teachers taught students to pace themselves using the clock). Regular times were scheduled each day to quickly review independent work (so that difficulties could be identified and follow-up assistance offered quickly). The teachers regularly circulated through the room during seatwork, checking each student's progress. Completed papers were returned to students with feedback as soon as possible. In general, effective managers showed concern about maximizing the time available for instruction and saw that their students learned the content—not just that they remained quiet.

Behaviors that taught students how to behave appropriately. Effective managers were clear about what they expected and what they would not tolerate. In particular, they focused on what students should be doing and, when necessary, on teaching them how to do it. This included the "don'ts" involved in keeping order and reasonable quiet in the classroom but stressed behaviors that were more prescriptive and learning related, such as how to read and follow directions for independent work. Responses to failure to follow these procedures stressed specific, corrective feedback rather than criticism or threat of punishment. In general, the emphasis was on teaching (presumably willing) students what to do and how to do it, rather than on manipulating (presumably unwilling) students through reward and punishment.

Teacher skills in diagnosing students' focus of attention. Effective managers were sensitive to students' concerns and continually watched for signs of confusion or inattention. They arranged desks so that students could easily face the point in the room where they most often focused attention. They used variations in voice, movement, and pacing to refocus attention during lessons. Daily activities were scheduled to coincide with changes in students' readiness to attend versus need for physical activity. Activities had clear beginnings and endings, with efficient transitions in between. In general, the teachers required the active attention of all students when giving important information.

Even after the early weeks of the school year, effective managers were consistent in maintaining desired routines. They devoted less time to procedural instruction and practice but continued to give reminders and remedial instruction when necessary and remained consistent in enforcing expectations.

Follow-up work at the junior high school level (Evertson and Emmer 1982; Sanford and Evertson 1981) revealed similar differences between effective and ineffective classroom managers, although the junior high school teachers did not need to put as much emphasis on teaching the students to follow rules and procedures. It was especially important, however, for junior high school teachers to communicate expectations clearly, monitor students for compliance, and enforce students' responsibility for engaging in and completing assignments (see also Moscowitz and Hayman 1976).

More recently, the Texas R & D Center research team has followed up its observational studies with intervention studies, in which teachers are trained in effective classroom management, using extremely detailed manuals based on earlier work. These intervention studies have improved teachers' classroom-management skills and, consequently, students' task-engagement rates (Evertson, Emmer, Sanford, Clements, and Martin, in press; Emmer, Sanford, Clements, and Martin 1982). As intervention studies were completed, the training manuals were revised and made available to teachers and teacher educators. These included both an elementary manual (Evertson, Emmer, Clements, Sanford, Worsham, and Williams 1981) and a junior high manual (Emmer, Evertson, Sanford, Clements, and Worsham 1982).

Supplemental Group Management Techniques

The classroom-organization and management techniques identified by Kounin and his colleagues and by Evertson, Emmer, Anderson, and their colleagues complement one another and, taken together, appear both necessary and sufficient for establishing the classroom as an effective learning environment. It is clear from this research that the key to effective classroom management is prevention: Effective classroom managers are distinguishable by their success in preventing problems from arising in the first place, rather than by special skill in dealing with problems once they occur. It is also clear that their success is not achieved through a few isolated techniques or gimmicks but instead results from a systematic approach to classroom management that starts with preparation and planning before the school year begins, is implemented in the first weeks of school through systematic communication of expectations and establishment of procedures and routines, and is maintained throughout the year, not only by consistency in following up on stated expectations, but by presenting students with well-chosen and well-prepared activities that focus their attention during group lessons and engage their concentrated efforts during independent work.

Such a thorough and integrated approach to classroom management, if implemented continuously and linked with similarly thorough and effective instruction, enables teachers to prevent most problems from occurring in the first place and to handle those that do occur with brief, nondisruptive techniques. This approach appears both necessary (less intensive or systematic efforts are unlikely to succeed) and sufficient (the teacher establishes the classroom as an effective learning environment without requiring more intensive and cumbersome techniques such as token economies). Yet some students with serious personal or behavioral problems will require individualized treatment in addition to (not instead of) the group-management techniques described above, and many teachers will want to pursue broader student socialization goals beyond establishing the classroom as an effective learning environment (developing good group dynamics, promoting individuals' mental health and personal adjustment, etc.). Additional techniques beyond those already described can and should be used for these purposes, although it should be recognized that they are supplements to, not substitutes for, the set of basic techniques already described.

Group Relationships

Recent research has produced a great deal of information useful to teachers concerned about establishing good interpersonal relationships and group dynamics in their classrooms, including information about how to overcome social barriers often associated with differences in sex, race, social class, or achievement. This research makes it clear that merely bringing antagonistic or voluntarily segregated groups together for frequent contact will not by itself promote prosocial, integrated activities (in fact, it may even increase conflict). Prosocial outcomes may be expected, however, when students from different groups are not merely brought together but are involved in cooperative activities, especially interdependent activities that require the active participation of all group members to ensure accomplishment of a mission (Aronson, Blaney, Stephan, Sikes, and Snapp 1978; Johnson and Johnson 1975; Sharan 1980; Slavin 1980).

An example is the "jigsaw" approach (Aronson et al. 1978), in which group activities are arranged so that each member of the group possesses at least one bit of unique information that is essential to the group's success. This requires the brighter and more assertive students who might ordinarily dominate group interaction (Webb 1980) to encourage the active participation of everyone and to value everyone's contribution. It also encourages slower and more reticent students, who might otherwise contribute little or nothing, to participate in group activities and consider themselves important contributors.

The "teams-games-tournaments" (TGT) approach accomplishes similar goals in a different way (Slavin 1980): Students are divided into teams (in which members vary in sex, race, achievement, etc.) that compete for prizes for academic excellence. In addition to working together as a team on cooperative activities included in the program, team members contribute to their teams' point totals through their performance on seatwork and other independent activities. Each team member contributes roughly equally to the team's relative success, because points are awarded according to a handicapping system in which performance standards are based on each individual's previous level of success. Thus, low achievers who meet the performance standards assigned to them contribute as much to their team's total score as do high achievers who meet the performance standards assigned to them. This approach has been shown to improve the quantity and quality of contact among team members inside and outside of the classroom and sometimes leads to improved achievement in addition to improved interpersonal relationships.

Other approaches in which group members cooperate to pursue common goals have been successful in promoting good group dynamics (see Stanford 1977, regarding the formation and development of classroom groups). Approaches that allow individuals to display unique knowledge or skills have been successful in enhancing the social status or peer acceptance of the individuals involved. In general, successful techniques have in common the fact that they do not merely bring together individuals who seldom interact, but bring them together in ways that require them to cooperate or allow them to see positive attributes in one another that they might otherwise have overlooked. In addition to these group-based approaches, there are a variety of social skills training approaches that teachers can use for such purposes as helping socially isolated or rejected students learn to initiate prosocial contacts with their peers (Cartledge and Milburn 1978) or helping high school students prepare for job interviews (Sarason and Sarason 1981).

Behavior-Modification Techniques

Techniques of behavior analysis and behavior modification are often recommended to teachers based on social learning theory: Reward desirable behavior and extinguish (by ignoring) undesirable behavior, or, if necessary, punish undesirable behavior (O'Leary and O'Leary 1977; Krumboltz and Krumboltz 1972). Early applications of social learning theory were mostly limited to the shaping of behaviors (such as staying in one's seat or remaining quiet) of individual students through material or social reinforcement. Since then, systems have been developed for use with whole classes and even whole schools (Boegli and Wasik 1978; Thompson, Brassell, Persons, Tucker, and Rollins 1974). Experts have noted a shift of emphasis from inhibiting misconduct to rewarding good academic performance (Kazdin 1977) and from controlling students externally to teaching them to control themselves (Meichenbaum 1977; McLaughlin 1976), and techniques have proliferated. Procedures for increasing desired behavior include praise and approval, modeling, token reinforcement programs, programmed instruction, self-specification of contingencies, self-reinforcement, establishment of clear rules and directions, and shaping. Procedures for decreasing undesirable behavior include extinction, reinforcing incompatible behaviors, self-reprimands, time out from reinforcement, relaxation (for fears and anxiety), response cost (punishment by removal of reinforcers), medication, self-instruction, and self-evaluation. The breadth of this list indicates the practical orientation of contemporary behavior modifiers, as well as the degree to which they have embraced techniques that originated elsewhere and have little or nothing to do with social learning theory or reinforcement.

Most of the early reinforcement-oriented behavior modification approaches proved impractical for the classroom. For example, the financial and time costs involved in implementing token economy systems make these approaches unacceptable to many teachers (MacMillan and Kolvin 1977), although token economies have been popular with special education teachers working in resource rooms where individualized learning programs and a low student-teacher ratio make such an approach more feasible (Safer and Allen 1976). Approaches based on social rather than material reinforcement are less cumbersome, but they have problems of their own. For one thing, a single teacher working with a class of 30 students will not be able even to keep track of, let alone systematically reinforce, all of the desirable behaviors of each student (Emery and Marholin 1977). Secondly, praise and other forms of social reinforcement by teachers do not have powerful effects on most students, at least after the first grade or two in school. Thirdly, the "praise-and-ignore" formula so often recommended as a method of shaping desirable behavior conceals drawbacks that limit its effectiveness in classrooms. Praising the desirable behavior of classmates is a less efficient method of shaping the behavior of the target student than is more direct instruction or cuing. Further, ignoring undesirable behavior will have the effect of extinguishing it only if the behavior has been reinforced by the teachers' attention. This is probably true of only a small minority of the undesirable behaviors students display, and even where it is true, ignoring the problem may lead to escalation in intensity or may cause the problem to spread to other students, as Kounin (1970) has shown. Thus, the principles of extinction through ignoring and of shaping behavior through vicarious reinforcement of peers of the target student cannot often be applied in the ordinary classroom and certainly cannot be used as the basis for a systematic approach to classroom management.

Figure 1.

Guidelines for effective praise.[2]

Effective Praise	Ineffective Praise
1. is delivered contingently.	1. is delivered randomly or unsystematically.
2. specifies the particulars of the accomplishment.	2. is restricted to global positive reactions.
3. shows spontaneity, variety, and other signs of credibility; suggests clear attention to the student's accomplishment.	3. shows a bland uniformity which suggests a conditioned response made with minimal attention.
4. rewards attainment of specified performance criteria (which can include effort criteria, however).	4. rewards mere participation, without consideration of performance processes or outcomes.
5. provides information to students about their competence or the value of their accomplishments.	5. provides no information at all or gives students information about their status.
6. orients students toward better appreciation of their own task-related behavior and thinking about problem solving.	6. orients students toward comparing themselves with others and thinking about competing.
7. uses students' own prior accomplishments as the context for describing present accomplishments.	7. uses the accomplishments of peers as the context for describing students' present accomplishments.
8. is given in recognition of noteworthy effort or success at difficult (for *this* student) tasks.	8. is given without regard to the effort expended or the meaning of the accomplishment (for *this* student).
9. attributes success to effort and ability, implying that similar successes can be expected in the future.	9. attributes success to ability alone or to external factors such as luck or (easy) task difficulty.
10. fosters endogenous attributions (students believe that they expend effort on the task because they enjoy the task and/or want to develop task-relevant skills).	10. fosters exogenous attributions (students believe that they expend effort on the task for external reasons—to please the teacher, win a competition or reward, etc.).
11. focuses students' attention on their own task-relevant behavior.	11. focuses students' attention on the teacher as an external authority figure who is manipulating them.
12. fosters appreciation of, and desirable attributions about, task-relevant behavior after the process is complete.	12. intrudes into the ongoing process, distracting attention from task-relevant behavior.

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[2] From Brophy, Jere E., "Teacher Praise: A Functional Analysis." *Review of Educational Research*, Spring 1981, pp. 5-32. Copyright 1981, American Educational Research Association, Washington, D.C.

Reinforcement may be used efficiently to shape behavior when it is applied directly to the target student and delivered as a consequence of the performance of desired behavior (at least to some degree; it has become clear that the reinforcers under the control of most teachers are numerous but weak, so that certain behaviors by certain students cannot literally be controlled by teacher-administered reinforcement). Although reinforcement can bring about desired behavior and even academic performance, it does so through processes of extrinsic motivation, which may reduce the degree to which students find working on or completing tasks to be intrinsically rewarding (Lepper and Greene 1978). The degree to which this is likely to occur depends on the degree to which students are led to believe that they are performing solely to obtain extrinsic rewards, rather than because the performance is inherently satisfying or involves the acquisition or exercise of valued skills. Thus, the motivational effect of controlling students' behavior through reinforcement is determined by the meanings that students are led to attribute to the reinforcement process. Drawing on the work of several attribution theorists, Brophy (1981) developed the guidelines shown in Figure 1 for using praise in ways that not only shape students' behavior but encourage rather than discourage their development of associated, intrinsic motivation. The same guidelines apply to the use of any reinforcer, not just praise.

Notice that the principles summarized in Figure 1 stress teaching students to think about their behavior rather than merely reinforcing it. They also stress the development of self-monitoring and self-control of behavior. The principles are representative of the general changes that have been introduced into applications of behavior modification to classrooms. For example, teachers desiring to shape student behavior through reinforcement are now advised not merely to reinforce contingently but to draw up a formal contract with the student in advance, specifying precisely the performance standards that must be attained to earn rewards. This "contingency contracting" approach can be used to specify improvements in both conduct and academic performance. The technique allows teachers to individualize arrangements with students; it places more emphasis on student self-control, self-management, and self-instruction, less on one-to-one relationships between specific behaviors and specific rewards. Contracts may be helpful in dealing with students who are poorly motivated, easily distracted, or resistant to school work or the teacher.

Experience with some of the elements involved in contingency contracting, such as goal setting and self-monitoring of behavior, led to the realization that these elements can have important positive effects of their own, independent of reinforcement. For example, inducing students to set goals for themselves may lead to performance gains, especially if the goals are specific and difficult rather than vague or too easy (Rosswork 1977). Apparently, engaging in goal setting not only gives students specific objectives to pursue but leads them to concentrate their efforts and monitor their performance more closely. However, the process does not work always or automatically. Sagotsky, Patterson, and Lepper (1978) found that exposure to goal-setting procedures had no significant effect on students' study behavior or academic achievement, largely because many of the students did not follow through by actually using the goal-setting procedures they had been shown.

That same study did show the effectiveness of self-monitoring procedures, however. Students taught to monitor and maintain daily records of their study behavior did show significant increases in both study behavior and tested achievement (Sagotsky, Patterson, and Lepper 1978). This was but one of many studies illustrating the effectiveness of procedures designed to help students monitor their classroom behavior more closely and control it more effectively (Glynn, Thomas, and Shee 1973; McLaughlin 1976; O'Leary and Dubey 1979; Rosenbaum and Drabman 1979). These procedures, based on developing self-control in students, have two potential advantages over earlier procedures that depended on external control by the teacher (to the extent that they are implemented successfully). First, as noted previously, reinforcement-oriented approaches to classroom management that depend on the teacher as the dispenser of reinforcement are impractical in the typical classroom, in which a single teacher must deal with 30 students. Even the most skillful and determined teacher cannot continuously monitor all of the students and reinforce all of them appropriately. When responsibility for monitoring (and perhaps reinforcing) performance is shifted from teacher to students, the burden is eased. Second, to the extent that teachers succeed in using behavior modification to shape students' behavior, the effects depend on the presence and activity of the teacher and thus do not generalize to other settings or persist beyond the term or school year. Again, to the extent that students can learn to monitor and control their behavior in school, they may also be able to apply these self-control skills in other classrooms or even in nonschool settings.

Self-control skills are typically taught to students using a variety of recently developed procedures that Meichenbaum (1977) has called "cognitive behavior modification." One such technique combines modeling with verbalized self-instructions. Rather than just tell students what to do, the teacher demonstrates the process. The demonstration includes not only the physical motions involved, but verbalization of the thoughts and other self-talk (self-instructions, self-monitoring, self-reinforcement) that might accompany the physical motions involved in the task. For example, Meichenbaum and Goodman (1971) used the technique with cognitively impulsive students who made many errors on a matching-to-sample task because they responded too quickly, settling on the first response that looked correct rather than taking time to examine all of the alternatives and select the best one. Earlier studies had shown that simply telling these students to take their time, or even requiring them to delay their response for a specified period, did not improve their performance because the students did not use the time to examine the alternatives. The students simply waited until the delay period was over. However, the technique of modeling with verbalized self-instructions stressed the importance of carefully observing each alternative. As the models thought out loud while demonstrating the task, they made a point of resisting the temptation to settle on an alternative that looked correct before examining all of the rest, reminded themselves that one may overlook small differences in detail at first glance, and so on. This approach improved performance on the task, because the students learned to compare carefully each alternative with the model before selecting a response. Rather than merely imposing a delay on their speed of response, the treatment presented them with a strategy for responding to the task successfully and presented this strategy in a form that the students could easily understand and apply.

Modeling combined with verbalized self-instructions (as well as related role-play approaches) may be helpful with a variety of student problems. Meichenbaum (1977) described five stages to this approach: (1) an adult models a task while speaking aloud (cognitive modeling); (2) the child performs the task under the model's instruction (overt, external guidance); (3) the child performs the task while verbalizing self-instructions (overt self-guidance); (4) the child whispers self-instructions while doing the task (faded, overt self-guidance); and (5) the child performs the task under self-guidance via private speech (covert self-instruction). Variations of this approach have been used not only to teach cognitively impulsive children to approach tasks more effectively, but also to help social isolates learn to initiate activities with their peers, to teach students to be more creative in problem solving, to help aggressive students learn to control anger and respond more effectively to frustration, and to help frustrated, defeated students learn to cope with failure and respond to mistakes with problem-solving efforts rather than withdrawal or resignation.

Recent applications include the "turtle" technique of Robin, Schneider, and Dolnick (1976), in which teachers teach impulsive and aggressive students to assume a "turtle" position when upset. The students place their heads on their desks, close their eyes, and clench their fists. This gives them an immediate response to use in anger-provoking situations and buys time that enables them to delay inappropriate behavior and think about constructive solutions to the problem. Actually, the turtle position is not essential; the key is training children to delay impulsive responses while they gradually relax and think about constructive alternatives. However, the turtle idea is a gimmick that many younger students find enjoyable, and it may serve as a sort of crutch for children who otherwise might not be able to delay successfully.

Similarly, the "Think Aloud" program of Camp and Bash (1981) is designed to teach children to use their cognitive skills to guide their social behavior and to cope with social problems. It is especially useful with students in the early grades, especially those prone to paranoid interpretations of peers' behavior or aggressive acting out as a response to frustration. In general, although generalization of skills taught through cognitive interventions has not yet been demonstrated convincingly (Kennedy 1982; Pressley 1979), approaches featuring modeling, verbalized self-instructions, and other aspects of self-monitoring and self-control training hold promise for use in classrooms, both as instructional techniques for students in general and as remediation techniques for students with emotional or behavioral problems (McLaughlin 1976; O'Leary and Dubey 1979; Rosenbaum and Drabman 1979; Urbain and Kendall 1980).

Individual Counseling and Therapy

In addition to behavior modification, a variety of techniques developed by counselors and psychotherapists have been recommended for use by teachers with students who have chronic personal or behavioral problems. Early on, many of these approaches stressed psychoanalytic or other "depth" interpretation of behavior and treatment through methods such as free association or acting out of impulses against substitute objects to achieve catharsis or gratification. Many of these early theories have proven unnecessary or incorrect; the early treatments have proven ineffective or infeasible for consistent use by most teachers.

More recently, however, therapy-based suggestions to teachers have shifted concern from unconscious motives to overt behaviors; from long-term, general treatment toward briefer crisis intervention; and from viewing disturbed students as "sick" toward viewing them as needing information or insight that will allow them to understand themselves better and achieve better control over their emotions and behavior. As a result, these therapy-based notions have become more compatible with one another and with the cognitive behavior-modification approaches described above. Suggestions from different sources are mostly complementary rather than contradictory; taken together, they provide the basis for systematic approaches to counseling problem students.

Dreikurs (1968) viewed disturbed students as reacting to feelings of discouragement or inferiority by developing defense mechanisms designed to protect self-esteem. He believes that students who do not work out satisfactory personal and group adjustments at school will display symptoms related to seeking after one of the following goals (listed in increasing order of disturbance): attention, power, revenge, or display of inferiority. He then suggested how teachers can de[illegible] the purpose of students' symptoms by analyzi[illegible] that the students seem to pursue and the effects that the students' behavior seems to have on the teacher. In addition, Dreikurs suggested ways that teachers may use this information to help students eliminate their need to continue such behavior.

Morse (1971) described the "life space interview," in which teachers work together with students until each understands troublesome incidents and their meaning to the student and until ways to prevent repetition of the problem are identified. During these interviews, the teacher lets the student vent feelings and makes an effort to appreciate the students' perceptions and beliefs, but at the same time forces the student to confront unpleasant realities, tries to help the student develop new or deeper insights, and, following emotional catharsis and problem analysis, seeks mutually agreed-upon solutions.

Good and Brophy (1978, 1980) presented similar advice about maintaining a neutral but solution-oriented stance in dealing with student conflict, conducting investigations in ways that are likely to obtain the desired information and avoid escalating the conflict, negotiating agreements about proposed solutions, obtaining commitment, and promoting growth through modeling and communication of positive expectations.

Gordon (1974) discussed the need to analyze the degree to which parties to a conflict "own" the problem. The problem is owned by the teacher if only the teacher's needs are frustrated (as when a student persistently disrupts class by socializing with friends). Conversely, the student owns the problem when the student's needs are frustrated (as when a student is rejected by peers through no fault of the teacher). Finally, teachers and students both own problems in which each frustrates the needs of the other. Gordon argued that student-owned problems call for a generally sympathetic and helpful stance and, in particular, an attempt to understand and clarify the student's problem through "active listening." During active listening, the teacher not only listens carefully to the student's message, tries to understand it from the student's point of view, and reflects it accurately to the student, but also listens for the feelings and reactions of the student to the events being described and reflects understanding of these to the student. When the teacher owns the problem, he or she must communicate the problem to the student using "I" messages that state explicitly the linkages between the student's troublesome behavior, the problem that this behavior causes the teacher (how it frustrates the teacher's needs), and the effects of these events on the teacher's feelings (discouragement, frustration). The idea is to minimize blame and ventilation of anger and to get the student not only to recognize the problem behavior itself, but to see its effects on the teacher.

Gordon believed that active listening and "I" messages help teachers and students achieve shared, rational views of problems and assume a cooperative, problem-solving attitude. To the extent that conflicts are involved, he recommended a "no lose" method of finding the solution that will work best for all concerned. The six steps in the process are: define the problem; generate possible solutions; evaluate those solutions; decide which is best; determine how to implement this decision; and, later, assess how well the solution is working (with negotiation of a new agreement if the solution is not working satisfactorily to all concerned).

Glasser (1969, 1977) suggested applications of what he called "reality therapy," an approach that provides guidelines for both general classroom management and problem solving with individual students. The title of Glasser's book, *Schools Without Failure* (1969), illustrates his interest in a facilitative atmosphere in the school at large, not just in individual teacher-student relationships. In the book, Glasser advocated classroom meetings, in which teachers and students jointly establish classroom rules, adjust these rules, develop new ones when needed, and deal with problems. This part of his approach is less well-accepted than his later suggestions: Many teachers oppose student self-government on principle; others find it cumbersome and time consuming. Also, it may involve exposure of vulnerable individuals to public scrutiny and pressure, violation of confidences, and other ethical problems.

More recently, Glasser (1977) advanced what he called his "ten steps to good discipline," which he described as a constructive, nonpunitive, but no-nonsense approach. The plan is predicated on the beliefs that students must be held responsible for their in-school behavior; that rules must be reasonable and fairly administered; and that teachers must maintain a positive, problem-solving stance in dealing with students.

Glasser's 10-step approach was intended for use with students who do not respond to generally effective classroom management (thus, like other techniques described in this section, it is a supplement to the general principles described earlier in the paper and not a starting place or basis for managing a class as a whole). Each consecutive step represents an escalation in the seriousness of the problem and thus should not be implemented lightly. The steps are as follows:

1. Select a student for concentrated attention and list typical reactions to the student's disruptive behavior.
2. Analyze the list to see what techniques do and do not work and resolve not to repeat the ones that do not work.
3. Improve personal relationships with the student by providing extra encouragement, asking the student to perform special errands, showing concern, implying that things will improve, and so on.
4. Focus the student's attention on the disruptive behavior by requiring the student to describe what he or she has been doing. Continue until the student describes the behavior accurately and then request that he or she stop it.
5. Call a short conference; again, have the student describe the behavior and state whether or not it is against the rules or recognized expectations. Then ask the student what he or she should be doing instead.
6. Repeat step five, but this time add that a plan will be needed to solve the problem. The plan will be more than a simple agreement to stop misbehaving, because such a plan has not been honored in the past. The negotiated plan must include the student's commitment to positive action to eliminate the problem.
7. Isolate the student or use time-out procedures. During these periods of isolation, the student will be charged with devising his or her own plan for ensuring compliance with rules in the future. Isolation will continue until the student has devised such a plan, gotten it approved by the teacher, and made a commitment to follow it.
8. If this does not work, the next step is in-school suspension. Now the student must deal with the principal or someone other than the teacher, but this other person will repeat earlier steps in the sequence and press the student to come up with a plan that is acceptable. It is made clear that the student will either return to class and follow the rules in effect there or continue to be isolated from the class.
9. If students remain out of control or under in-school suspension, their parents are called to take them home for the day and the process is repeated starting the next day.
10. Students who do not respond to the previous steps are removed from school and referred to another agency.

Little systematic research exists on the strategies described in this section. Survey data reported by Glasser (1977) indicated that implementation of his program has been associated with reductions in referral to the principal's office, fighting, and suspensions, but neither his program nor any of the others described here has been evaluated systematically to the degree that behavior-modification approaches have been evaluated. In part, this is because many of these approaches are new, so that many teachers have not yet heard of them and few have received specific training in them.

This lack of training slowed clearly in a study by Brophy and Rohrkemper (1981), who observed and interviewed 44 teachers working in the inner-city schools of a large, metropolitan school system and 54 teachers working in more heterogeneous schools in a smaller city. All of the teachers had had at least three years of experience (most had 10 years or more). Half were nominated by their principals as outstanding in dealing with problem students; half were described as average in this regard.

Few of these teachers had had significant preservice or inservice training in how to manage classrooms or cope with problem students, so most had to learn from other teachers and from experience. Although many were quite successful, many were not; even most of those who were successful relied on an unsystematic, bag-of-tricks approach developed through experience and had problems articulating exactly what they did and why they did it. Gordon's notion of problem ownership proved useful in predicting the responses of these teachers to classroom problems: Most teachers responded with sympathy and attempts to help students who presented student-owned problems but reacted unsympathetically and often punitively to students who presented teacher-owned problems. However, few teachers were aware of the term *problem ownership* or of Gordon's suggestions for handling classroom conflicts and none used the problem-ownership concept in conjunction with the problem-solving methods Gordon suggested.

Teachers' responses to interviews about general strategies for dealing with problem students, along with their response to vignettes depicting problems that such students typically cause in the classroom, did show some consistent correlations with principals' and observers' ratings of teacher effectiveness at dealing with problem students. One basic factor was willingness to assume responsibility. Teachers rated as effective tried to deal with the problem personally, whereas teachers rated as ineffective often disclaimed responsibility or competence to deal with the problem and attempted to refer it to the principal or someone else (counselor, social worker, etc.). Effective teachers often involved these other professionals as part of their attempt to deal with the problem but remained involved personally and did not try to turn over the problem to others, as did the ineffective teachers.

The second general difference was that the effective teachers used long-term, solution-oriented approaches to problems, whereas the ineffective teachers stressed short-term, desist/control responses. Effective teachers checked to see if symptomatic behavior was caused by underlying personal problems (including home problems), and if so, what might be done about the underlying problems. If they suspected that students were acting impulsively or lacked sufficient awareness of their behavior and its effects on others, they called for socialization of the students to provide them with needed information and insights. If behavioristically oriented, the teachers considered offering incentives, negotiating contracts, or devising other ways to call attention to and reinforce desirable behavior. If insight oriented, they called for spending time with problem students individually, attempting to instruct and inform them, getting to know them better, and fostering insight with techniques much like Gordon's active listening. If the teachers had more of a self-concept/personal adjustment orientation, they spoke of encouraging discouraged students, building self-esteem by arranging for and calling attention to successes, improving peer relationships, and so on. All of these approaches were more effective than were approaches limited to controlling troublesome behavior in the immediate situation without attempting to deal with larger, underlying problems, and more effective than doing nothing. None of the apparently effective approaches, however, seemed clearly superior to the others in every respect. In fact, a follow-up study (Rohrkemper 1981) comparing teachers who used behavior-modification approaches successfully with teachers who used induction (insight-oriented) approaches successfully suggested that each approach has its (desirable) effects, so that a combined approach is better than an emphasis on one to the exclusion of the other.

Context Differences

So far, this paper has been written as if principles of effective classroom organization and management were identical for all teachers and settings. To an extent, this is true. Advanced planning and preparation; clarity about rules, routines, and procedures; care in establishing these at the beginning of the year and following up on them thereafter; and regular use of the group-management techniques described by Kounin (1970) (integrated with an effective instructional program) are important in any classroom. So is the teacher's willingness to assume responsibility for exercising authority and socializing students by communicating expectations, providing instruction, stimulating insight, helping students set and pursue goals, resolving conflicts, and solving problems. A great deal of classroom-based research exists to help teachers develop many of these skills; consensus of opinion supports most of the rest. Thus, an internally consistent, mutually supportive collection of ideas and techniques has emerged for training teachers in effective classroom management.

Room for individual differences remains, however. For example, although it is important that students have a clear understanding about classroom rules and expectations, teachers may follow their preferences about how these rules are determined (on a continuum from the teacher as the authority who sets rules to a democratic approach in which rules are adopted by majority vote at class meetings). Similarly, classrooms can be managed quite nicely without reliance on contingent reinforcement, but there is no reason that teachers who enjoy or believe in rewarding their students for good performance should not do so (although the principles outlined in Figure 1 should be kept in mind). As another example, it seems important that students have clear options available to them when they finish their assigned work and that they learn to follow expectations concerning these options. What the options are, however, will be determined mostly by one teacher's preferences and beliefs about what is important. (Options may require students to stay in their seats or may involve moving to learning or enrichment centers; they may be either subject-related or recreational.)

In addition to these differences relating to teacher preference, there will be differences in what is appropriate for different classes. Brophy and Evertson (1978) identified four general stages of student intellectual and social development that have implications for classroom management:

Stage one (kindergarten through grade 2 or 3). Most children are compliant and oriented toward conforming to and pleasing their teachers, but they must be socialized into the student role. They require a great deal of formal instruction, not only in rules and expectations, but in classroom procedures and routines.

Stage two (grades 2-3 through grades 5-6). Students have learned most of what they need to know about school rules and routines and most remain oriented toward obeying and pleasing their teachers. Consequently, less time needs to be devoted to classroom management at the beginning of the year; less cuing, reminding, and instructing is required thereafter.

Stage three (grades 5-6 through grades 9-10). Students enter adolescence and become less eager to please teachers and more eager to please peers. Many become resentful or at least questioning of authority; disruptions due to attention seeking, humorous remarks, and adolescent horseplay become common. Classroom management again becomes more time consuming, but, in contrast to stage one, the task facing teachers is not so much one of instructing willing but ignorant students about what to do as it is one of motivating or controlling students who know what to do but will not always do it. Also, individual counseling becomes more prominent, as the relative stability of most students in the middle grades gives way to the adjustment problems of adolescence.

Stage four (after grades 9-10). Most students become more settled and oriented toward academic learning again. As in stage two, classroom management requires less time and trouble; classrooms take on a more businesslike, academic focus.

Note that these grade-level differences in classroom management lie more in the amount of effort needed and degree of emphasis given to management tasks, not in the underlying principles of management. This seems to be the case with regard to other individual and group differences in students, as well. At any given grade level, the same basic classroom-management principles and strategies seem to apply for boys as well as girls, blacks as well as whites, and for students of various ethnic and social class groups. Physically handicapped students mainstreamed into regular classrooms may require special arrangements or assistance (see Chapter 24 in Good and Brophy 1980), but this will be in addition to, rather than instead of, the principles described here. Similarly, these principles apply as well to students labeled emotionally disturbed as to other students (Borg and Ascione 1982; Kounin and Obradovic 1968), although disturbed students may need more individualized attention and closer monitoring.

Within limits, adaptation to local expectations or common practice is appropriate. For example, middle-class teachers typically expect students to maintain eye contact with them during disciplinary contacts as a sign of attention and respect. However, individuals in certain minority groups are taught to avert their eyes in such situations; for them, maintaining eye contact may connote defiance. Obviously, it is important for teachers working with such individuals to understand such cultural differences so as to interpret their students' behavior correctly and respond appropriately. Similarly, such teachers must be especially careful to avoid unnecessary conflicts with students. For example, student-monitor assignments should not place students in conflict with their peers; appointments to peer-leadership positions should require the involvement or at least the support of the existing peer leaders (Roberts 1970; Riessman 1962). In general, it seems important for teachers of any background and in any setting to be open-minded and tolerant in dealing with students who come from different social or cultural backgrounds.

However, this does not necessarily mean catering to students or automatically reinforcing their expectations. For example, middle-class teachers accustomed to forbidding violence and language they consider obscene tend to become noticeably more tolerant of these behaviors, presumably in deference to local mores, if assigned to work with lower-class students (Weiss and Weiss 1975). Yet Brookover, Beady, Flood, Schweitzer, and Wisenbaker (1979) have shown that the schools that are most effective with lower-class students are those that set and enforce standards for conduct and academic performance. Interviews with students regularly reveal concerns about safety and an expectation and desire for teachers to enforce standards of conduct in the classroom (Metz 1978; Nash 1976). Thus, certain behavior should not be accepted even if it is common in the area in which the school is located.

As another example, many students of low socioeconomic status are accustomed to authoritarian or even brutal treatment at home, but they do not need such treatment from their teachers. If anything, these students have greater need for and respond more positively to teachers' acceptance and warmth (Brophy and Evertson 1976). Specifically, in the case of minority-group students who are alienated from school learning and discriminated against by the majority of the student body, successful teaching involves a combination of warmth and determination in demanding academic effort and enforcing conduct limits (Kleinfeld 1975).

In general, then, the overall goals of classroom management for special students are the same as those for more typical students, although the specific methods used to accomplish these goals may differ. Distractible students may need study carrels or other quiet places to work; slow students may need tutoring or more frequent, personal help from the teacher; poor workers may need contracts or other approaches that provide a record of progress, break tasks into smaller segments, or afford more individualized reinforcement.

Conclusion

A comprehensive approach to classroom management must include attention to relevant student characteristics and individual differences, preparation of the classroom as an effective learning environment, organization of instruction and support activities to maximize student engagement in productive tasks, development of a workable set of housekeeping procedures and conduct rules, techniques of group management during active instruction, techniques of motivating and shaping desired behavior, methods of resolving conflict and dealing with students' adjustment problems, and orchestration of all these elements into an internally consistent and effective system. Clearly, no single source or approach treats all of these elements comprehensively.

However, the elements for a systematic approach to classroom management may be gleaned from various sources (particularly recent, research-based sources) that provide complementary suggestions (in particular, see Good and Brophy 1978, 1980, and Duke 1982). The research of Kounin and his colleagues and of Evertson, Emmer, Anderson, and their colleagues provided detailed information on how teachers can organize classrooms, begin the school year, and manage classrooms on an everyday basis. There is less research support for suggestions for counseling individual students and resolving conflicts, but cognitive behavior modifiers—Dreikurs, Glasser, Good and Brophy, Gordon, and Morse, among others—implicitly agree on a set of principles: respect for student individuality and tolerance for individual differences, willingness to try to understand and assist students with special needs or problems, reliance on instruction and persuasion rather than power assertion, and humanistic values generally. However, they also recognize that students have responsibilities along with rights, that students must suffer the consequences if they persistently fail to fulfill those responsibilities.

Finally, these ideas appear to mesh with the evolving role of the teacher as a professional, with particular expertise and specific but limited responsibilities to students and their parents and with certain rights as the instructional leaders and authority figures in the classroom.

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Teaching, Learning, and the Management of Instruction

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The present is an extraordinary time in the history of research on teaching. Syntheses of a large corpus of research are converging, demonstrating the consistency of educational effects. They are helping to place teaching on a sound, scientific basis and are likely, if their implications are followed, to increase educational productivity both inside and outside schools.

This paper draws heavily on quantitative synthesis of empirical research on teaching and, for comparison, related influences on learning, such as the student's motivation, home environment, and exposure to television. Accordingly, the first section explains the techniques of explicit search and selection of evidence and the statistical evaluation and summary of many primary research studies. The following sections are devoted to summarizing the substantive results of reviews and quantitative syntheses of research on teaching and on other influential factors in academic learning, including affective, behavioral, and cognitive aspects.

This paper, however, is not confined to reviews and quantitative syntheses alone. Psychology and educational research are becoming more theoretical. Drawing increasingly upon taxonomies, models, and theories to guide research on teaching, these fields offer paradigms and constructs for analysis and specification of forms of instruction ranging from mastery learning to informal or open education. Thus, the last sections of this paper treat a variety of theoretical and analytical approaches to teaching and instruction that provides a framework for further research and a guide to the practice of teaching and the education of teachers.

Quantitative Synthesis Methods

Quantitative research synthesis exceeds mere statistical analysis of studies. Jackson (1980) discussed six tasks involved in an integrative review or research synthesis: specifying the questions or hypotheses for investigation; selecting or sampling the studies for synthesis; coding or representing the characterisitics of the primary studies; analyzing, "meta-analyzing" (after Glass 1977 and Glass, McGaw, and Smith 1981), or statistically synthesizing the study findings; interpreting the results; and reporting them.

Although these tasks seem obviously necessary to allow replication of reviews, Jackson found that only 12 out of 87 recent reviews in prominent educational, psychological, and sociological journals provided even a cursory statement of methods. The guiding idea behind the good advice in Jackson's paper is that methods of review and synthesis should be explicit to enable other investigators to attempt to replicate them.

Explicit methods of quantitative synthesis call for statistics; two are most often employed: the vote count or box score and the effect size (Glass 1977). The vote count is easiest to calculate and explain to those unaccustomed to thinking statistically. It is simply the percentage of all studies that are positive, for example, the percentage of studies in which experimental exceeded control groups or the independent variable correlated positively with the dependent variable.

The effect size is the difference between the means of the experimental and control groups divided by the control-group standard deviation. It measures the average superiority (or inferiority, if negative) of the experimental relative to the control groups (for cases in which these statistics are unreported, Glass, McGaw and Smith 1981 provide a number of alternate estimation formulas).

Effect sizes permit a rough calibration of comparisons across tests, contexts, subjects, and other characteristics of studies. The estimates, however, are affected by the variances in the groups, the reliabilities of the outcomes, the match of curriculum with outcome measures, and a host of other factors whose influences, in some cases, can be estimated specifically or generally. Although effect sizes are subject to distortion, they are the only explicit means of comparing the sizes of effects in primary research that employs various outcome measures on nonuniform groups.

The most obvious question in quantitative synthesis concerns the overall percentage of positive results and their average magnitude. But subsequent questions should concern the consistency and magnitude of results across student and teacher characteristics, educational treatments and conditions, subject matters, study outcomes, and validity factors in the studies. These questions may be answered by calculating separate results for classifications or cross-classifications of these factors.

Notwithstanding the frequent claims by reviewers for

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Table 1

Conclusions of 19 Reviews and Quantitative[1] Syntheses of Research and Teaching

	Stimulation				
	Cognitive Cues	Motivational Incentives	Engagement	Reinforcement	Management and Climate
Number of Reviews Covering Construct	19	5	10	13	1.5
Number of Reviews Concluding Relation to Learning is Positive	17	5	10	9.5	13.5
Probability of an Even Split	.01	.10	.01	.10	.01
Mean Effect Sizes from Quantitative Synthesis	1.28		.88	.94	1.17
Probability of Evidence Assuming Zero Population Effect	.01		.01		

[1] From Walberg, Herbert J., "What Makes Schooling Effective? A Synthesis and Critique of Three National Studies." *Contemporary Education Review*, Spring 1982, p. 31. Copyright 1982, American Educational Research Association, Washington, D.C.

differential effects on the basis of a few studies, most research syntheses yield results that are robustly consistent in sign and magnitude across such categories. Such robustness is scientifically valuable because it indicates parsimonious, law-like findings. It is also educationally valuable because educators can apply robust findings more efficiently than complicated, expensive procedures, tailored, according to unproven assumptions, to special cases.

For further reading, several useful methodological writings are available. Glass (1977) provided a concise introduction to statistical methods; Glass, McGaw, and Smith's (1981) book offered a comprehensive treatment. Jackson (1980) and Cooper (1982) discussed tasks and criteria for integrative reviews and research syntheses. Light and Pillemer (1982) described methods for combining quantitative and qualitative methods. Walberg and Haertel (1980) commissioned eight methodological papers by Cahen, Cooper, Hedges, Light, Rosenthal, Smith, and others, as well as 35 substantive papers mostly on educational topics.

A Review of Reviews of Teaching Effects

The year 1980 marked a transition when investigators recognized the shortcomings of traditional reviews and the advantages of more objective, explicit procedures for evaluating and summarizing research. Yet, traditional reviews still have a place; something can be learned from them (see, for example, Peterson and Walberg 1979 for a recent collection of reflective reviews of teaching effects).

Waxman and Walberg (1982) examined 19 modern reviews of teaching-process/student-outcome research that critically reviewed at least three studies and two teaching constructs; Waxman and Walberg described each review's methods, compared their conclusions, synthesized them, and pointed out the implications for future reviews, syntheses, and prior research.

The 19 reviews reflected the inexplicit, varied, and vague standards revealed by Jackson's (1980) analysis of 87 review articles in prominent educational, psychological, and sociological journals. None of the reviews, for example, described search procedures, and only one stated explicit criteria for inclusion and exclusion of primary studies. Moreover, comparative analysis of the studies revealed that the reviewers failed to search diligently enough for primary studies or to state the reasons for excluding large parts of the research evidence. The most comprehensive of the five reviews covering positive reinforcement, such as praise and feedback in teaching, discussed only six studies, in contrast to the 39 listed in Lysakowski and Walberg's (1981) synthesis. Such arbitrary selection of small parts of the evidence, of course, leaves the reviews open to systematic bias and means that the reviews and their conclusions cannot be replicated in a strict sense because methods are undescribed.

Although the reviews purported to be critical, their coverage of the 33 standard threats to methodological validity was spotty and haphazard. In 95.4% of the possible instances, the reviews ignored specific validity threats.

Table 2

Selected Post-1979 Quantitative Syntheses

Author	Number of Studies	Independent and Dependent Variables	Mean Correlation or Effect	Percent Positive	Comments
Teaching Strategies					
Johnson, Maruyama, Johnson, Nelson, and Skon (1981)	122	Effects of cooperation, intergroup and interpersonal competition, and individual goal efforts on achievement and productivity	.00	54	Cooperative vs. group competitive
			.78	76	Cooperative vs. competitive
			.37	68	Group competitive vs. cooperative
			.76	83	Cooperative vs. individualistic
			.59	81	Group competitive vs. individualistic
			.03	47	Competitive vs. individualistic
Slavin (1980)	28	Effects of educational programs for cooperative learning		81	Curriculum-specific tests
				78	Standardized tests
				95	Race relations
				65	Mutual concern
Becker and Gersten (1982)	1	Effects of Direct Instruction Follow Through on later achievement (7 sites on 2 occasions, fifth and sixth grades)	.23	—	Effects larger for mathematics problem solving and for fifth grade
Pflaum, Walberg, Karagianes, and Rasher (1980)	96	Effects on learning of different methods of teaching reading	.60	76	Although Hawthorne effects could be discounted, experimental groups generally did substantially better than controls; sound-symbol blending was one standard deviation higher than other treatments.
Teaching Skills					
Luiten, Ames, and Anderson (1980)	135	Effects of advance organizers on learning and retention	.23	—	Effects larger on 20+ days retention, higher achievers, college students, and when presented aurally
Redfield and Rousseau (1981)	20	Effects of higher and lower cognitive questions	.73	—	Higher questioning effects greater in traning than in skills study and in more valid studies
Wilkinson (1980)	14	Effects of praise on achievement	.08	63	Praise slightly more effective for lower socioeconomic groups, primary grades, and in mathematics

Table 2 continued

Selected Post-1979 Quantitative Syntheses

Author	Number of Studies	Independent and Dependent Variables	Mean Correlation or Effect	Percent Positive	Comments
Other Studies					
Butcher (1981)	47	Effects of microteaching lessons on teaching performance of secondary and elementary education students	.84 .56 .46 .35		Secondary specific skills Secondary questioning skills Elementary specific skills Elementary questioning skills
Colosimo (1981)	24	Effects of practice and beginning teaching on self-attitudes	−.29	48	Initial experience associated with greater authoritarianism and self-doubt; inner-city experience more negative
Findley and Cooper (1981)	98	Correlations of locus of control and achievement	.18	79	Correlations higher among males; for adolescents in contrast to children and adult groups; for specific control measures; and for objective achievement

External validity (interaction of teaching treatments with selection, settings, and history) was relatively well covered, perhaps reflecting the search and claims for aptitude-treatment interactions of the 1970s; but the serious problem of internal validity, such as reverse and exogenous causes in correlational studies, was almost wholly ignored. There was also a tendency to select correlational studies rather than experiments for review.

Despite these problems, however, statistical tabulation of the conclusions of the reviews shows substantial and statistically significant agreement that five broad teaching constructs—cognitive cues, motivational incentives, engagement, reinforcement, and management and climate—are positively associated with student learning outcomes. These tabulations, moreover, are in close agreement with quantitative syntheses of large, systematic collections of primary studies discussed in a subsequent section.

Current Research Syntheses

Table 2 suggests a number of instructive points for both educational practice and research synthesis. The first two syntheses grouped under Teaching Strategies in Table 2 show fairly close agreement with respect to the positive effects of cooperative learning. Johnson and others (1981) categorized their results by comparisons of four treatment variations (cooperative, competitive, group competitive, and individualistic), whereas Slavin (1980) categorized his results by outcomes. Cooperative learning obviously produces superior results on average, but it would be useful if journal editors would allow research synthesists more space to report average results by greater numbers of standard classifications of independent and dependent variables and study conditions to facilitate comparisons of replicated syntheses such as these two.

Becker and Gersten's (1982) synthesis indicated a small average effect of direct instruction in several sites, but all effect sizes came from the same study. Independent replications by different investigators are in order to verify these results.

Pflaum and others (1980) found no average superiority to different reading methods but a substantial advantage in learning outcomes of experimental over control groups no matter what reading method was employed. Although Hawthorne effects could be discounted by the synthesis, the increased energy and attention devoted to tasks by teachers in experimental groups rather than the nominal

Table 3

A Selective Summary of a Decade of Educational Research

Research Topics	No. of Results	Percent Positive
Time on learning	25	95.4
Innovative curricula on:		
Innovative learning	45	97.8
Traditional learning	14	35.7
Smaller classes on learning:		
Pre-1954 studies	53	66.0
Pre-1954 better studies	19	84.2
Post-1954 studies	11	72.7
All Comparisons	691	60.0
Behavioral instruction on learning	52	98.1
Personal systems of instruction on learning	103	93.2
Mastery learning	30	96.7
Student- vs. instructor-led discussion on:		
Achievement	10	100.0
Attitude	11	100.0
Factual vs. conceptual questions on achievement	4	100.0
Specific teaching traits on achievement:		
Clarity	7	100.0
Flexibility	4	100.0
Enthusiasm	5	100.0
Task orientation	7	85.7
Use of student ideas	8	87.5
Indirectness	6	83.3
Structuring	3	100.0
Sparing criticism	17	70.6
Psychological incentives and engagement	10	100.0
Teacher cues to student	16	87.5
Teacher reinforcement of student	16	87.5
Teacher engagement of class in lesson	6	100.0
Individual student engagement in lesson	15	100.0
Open vs. traditional education on:		
Achievement	26	54.8
Creativity	12	100.0
Self-concept	17	88.2
Attitude toward school	25	92.0
Curiosity	6	100.0
Self-determination	7	85.7
Independence	19	94.7
Freedom from anxiety	8	37.5
Cooperation	6	100.0
Programmed instruction on learning	57	80.7
Adjunct questions on learning:		
After text on recall	38	97.4
After text on transfer	35	74.3
Before text on recall	13	76.9
Before text on transfer	17	23.5
Advance organizers on learning	32	37.5
Analytic revision of instruction on achievement	4	100.0
Direct instruction on achievement	4	100.0

Table 3 continued

A Selective Summary of a Decade of Educational Research

Research Topics	No. of Results	Percent Positive
Lecture vs. discussion on:		
Achievement	16	68.8
Retention	7	100.0
Attitudes	8	86.0
Student- vs. instructor-centered discussion on:		
Achievement	7	57.1
Understanding	6	83.3
Attitude	22	100.0
Factual vs. conceptual questions on achievement	4	100.0
Social-psychological climate and learning:		
Cohesiveness	17	85.7
Satisfaction	17	100.0
Difficulty	16	86.7
Formality	17	64.7
Goal direction	15	73.3
Democracy	14	84.6
Environment	15	85.7
Speed	14	53.8
Diversity	14	30.8
Competition	9	66.7
Friction	17	0.0
Cliqueness	13	8.3
Apathy	15	14.3
Disorganization	17	6.3
Favoritism	13	10.0
Motivation and learning	232	97.8
Social class and learning	620	97.6
Home environment on:		
Verbal achievement	30	100.0
Math achievement	22	100.0
Intelligence	20	100.0
Reading gains	6	100.0
Ability	8	100.0

[2] From Walberg, Herbert J., "What Makes Schooling Effective? A Synthesis and Critique of Three National Studies." *Contemporary Education Review*, Spring 1982. Copyright 1982, American Educational Research Association, Washington, D.C.

treatments themselves may partly account for superior results of treatment over control groups in teaching methods and other educational studies.

The effects of some teaching skills are also summarized in Table 2. The reader is referred to the original syntheses for details not discussed here. Overall, the results indicate a large range of effects, which, if replicated in further primary research and syntheses, could have important implications for educational policy and practice.

Synthesis of Bivariate Productivity Studies

A group at the University of Illinois at Chicago has concentrated on synthesizing research on several theoretical constructs that appear to have consistent causal influences on academic learning: student age or developmental level, ability (including prior achievement) and motivation; amount and quality of instruction; the psychological environments of the class, home, and peer group outside school; and exposure to mass media (Walberg 1980). The group first collected available vote counts and effects sizes in the review literature of the 1970s and then conducted more systematic syntheses directly on the factors. This section summarizes both efforts.

Synthesis of reviews of the 1970s. Walberg, Schiller, and Haertel (1979) collected reviews published from 1969 to 1979 on the effects of instruction and related factors on cognitive, affective, and behavioral learning in research conducted in elementary, secondary, and college classes and indexed in standard sources. The vote counts for the corpus of reviews are shown in Table 3.

The vote counts must be interpreted cautiously not only because journal editors may more often select studies with positive results, but because reviewers may select positive, published studies for summarization. Neither editors nor reviewers ordinarily state their policies on these important points.

Notwithstanding the possible double bias in the vote counts, the results in Table 3 are impressive. A majority of the variables in the table were positively associated with learning; in 68% of the 71 tabulations, 80% or more of the comparisons or correlations are positive. Although all of the variables are candidates for synthesis using systematic search, selection, evaluation, and summarization, it appears that the 1970s produced reasonably consistent findings that are likely to be confirmed by the more comprehensive and explicit methods of the present decade.

Syntheses of productivity factors. The group at the University of Illinois at Chicago also carried out syntheses of the factors using methods discusssed in previous sections of this chapter. The National Institute of Education supported the syntheses of learning research in ordinary classes, kindergarten through grade 12. A separate grant from the National Science Foundation on science learning, grades 6 through 12, permitted a more exhaustive, intensive search for unpublished work and an advisory group of science educators and research methodologists as well as a semi-independent replication of the results for several of the factors. A summary of the findings appears in Table 4.

All of the effect sizes (including mean contrasts and correlations) are in the expected direction. The mean effects for the two samples of studies are similar in magnitude, which suggests generality or robustness of effects across more and less intensive methods of synthesis. In particular, the syntheses of quality of instruction including cues, participation, and reinforcement of about 1.0 and .8 in general grades K-12 and in science grades 6-12 support the conclusions of the 19 reviews discussed in a previous section (see also Table 1). Despite these corroborations of findings, of course, independent replications of the syntheses as well as new and probing experimental studies are needed.

Syntheses of Multivariate Studies

The Chicago group also conducted multivariate analyses of the productivity factors in samples of from two to 3,000 13- and 17-year-old students who participated in the mathematics, social studies, and science parts of the National Assessment of Educational Progress (see, for example, Walberg, Pascarella, Haertel, Junker, and Boulanger 1982). These survey analyses complemented small-scale correlational and experimental studies in providing for representative national samples data on fairly comprehensive sets of the productivity factors, each of which may be statistically controlled for the others in multiple regressions of achievement and subject-matter interest. Such analyses allow a simultaneous assessment of qualities and amounts of instruction of other factors in the production of learning.

The results of these analyses indicated that the factors, when controlled for one another, were surprisingly consistent in sign, significance, and magnitude across subjects, ages, operational measures of the factors, and independent national samples. The median standardized regression weights and squared multiple correlations reveal that there are small-to-moderate effects of the factors when controlled for one's ability and prior achievement measures.

The strengths of the National Assessment data complement those of small-scale bivariate studies that typically control for only one or two of the factors. If syntheses of both data sources point in the same direction, then more confidence can be placed in the conclusions.

Syntheses of Instructional Theories

To specify the productivity factors in further theoretical and operational detail and provide a more explicit framework for future primary research and synthesis, Haertel, Walberg, and Weinstein (1983) compared eight contemporary psychological models of educational performance. Each of the first four factors in Table 5—student ability and motivation, and quality and quantity of instruction—may be essential or necessary but insufficient by itself for classroom learning (age and developmental level are omitted because they are unspecified in the models).

The other four factors in Table 5 are less clear: Although they consistently predict outcomes, they may support or substitute for classroom learning. At any rate, it would seem useful to include all factors in future primary research to rule out exogenous causes and increase statistical precision of estimates of the effects of essential and other factors.

Table 5 shows that, among the constructs, ability and quantity of instruction are widely and relatively richly specified among the models. Explicit theoretical treatments of motivation and quantity of instruction, however, are largely confined to the Carroll tradition represented in the first four models; the remaining factors are largely neglected.

The table poses empirically researchable, theoretical questions; the tension between theoretical parsimony and operational detail, for example, suggests several questions: Can the first four constructs mediate the causal influences

Table 4

Correlations and Effect Sizes for Nine Factors in Relation to School Learning

Factor	Number of Studies	Results and Comments
Instruction		
Amount	31	Correlations range from .13 to .71 with a median of .40; partial correlations controlling for ability, socioeconomic status, and other variables range from .09 to .60 with a median of .35
Quality	95	The mean of effect sizes for reinforcement in 39 studies is 1.17, suggesting a 38-point percentile advantage over control groups, although girls and students in special schools might be somewhat more benefited; the mean effect sizes for cues, participation, and corrective feedback in 54 studies is .97, suggesting a 33-point advantage. The mean effect size of similar variables in 18 science studies is .81.
Social-psychological Environment		
Educational	12	On 19 outcomes, social-psychological climate variables added from 1 to 54 (media = 20%) to accountable variance in learning beyond ability and pretests; the signs and magnitudes of the correlations depend on specific scales (see Table I), level of aggregation (classes and schools higher), nation, and grade level (later grades higher); but not on sample size, subject matter, domain of learning (cognitive, affective, or behavioral), or statistical adjustments for ability and pretests.
Home	18	Correlations of achievement, ability, and motivation with home support and stimulation range from .02 to .82 with a median of .37, multiple correlations range from .23 to .81 with a median of .44; studies of boys and girls and middle-class children in contrast to mixed groups show higher correlations (social classes correlations in 100 studies, by contrast, have a median of .25). The median correlations for three studies of home environment and learning in science is .32.
Media-TV	23	274 correlations of leisure-time television viewing and learning ranged from −.56 to 35 with a median of −.06, although effects appear increasingly deleterious from 10 to 40 hours a week and appear stronger for girls and high-IQ children.
Peer Group	10	The median correlation of peer group or friend characteristics such as socioeconomic status and educational aspirations with achievement-test scores, course grades, and educational and occupational aspirations is .24; correlations are higher in urban settings and in studies that reported aspirations and achievements of friends. The median of two sciences studies is .24.
Aptitude		
Age-development	9	Correlations between Piaget developmental level and school achievement range from .02 to .71 with a median of .35. The mean correlation in sciences is .40.
Ability	10	From 396 correlations with learning, mean verbal intelligence measures are highest (mean = .72) followed by total ability (.71), nonverbal (.64), and quantitative (.60); correlations with achievement test scores (.70) are higher than those with grades (.57). The mean ability-learning correlation in science is .48.

Table 4 continued

Correlations and Effect Sizes for Nine Factors in Relation to School Learning[3]

Factor	Number of Studies	Results and Comments
Motivation	40	Mean correlation with learning is .34; correlations were higher for older samples and for combinations of subjects (mathematics) and measures, but did not depend on type of motivation or the sex of the samples. The mean of three studies in science is .33.

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[3] From Walberg, Herbert J., "What Makes Schooling Effective? A Synthesis and Critique of Three National Studies." *Contemporary Education Review,* Spring 1982, p. 30. Copyright 1982, American Educational Research Association, Washington, D.C.

of the last four? Would assessments of Glaser's five student-entry behaviors allow more efficient instructional prescriptions than would, say, Carroll's, Bloom's, or Bennett's more general and more parsimonious ability subconstructs? Would fewer subconstructs than Gagne's eight instructional qualities and Harnischfeger and Wiley's seven time categories suffice?

The theoretical formulation of educational performance models of the past two decades since the Carroll and Bruner papers has made rapid strides. The models are explicit enough to be tested in ordinary classroom settings by experimental methods and production functions. Future empirical research and syntheses that are more comprehensive and better connected operationally to these multiple theoretical formulations should help reach a greater degree of theoretical and empirical consensus as well as more effective educational practice.

Strategies or Models Assumed in Instruction

The improvement of teaching often consists of attempts to emphasize teaching strategies derived from psychological models or strategies assumed in education. Three models have traditionally been proposed: selection, enrichment, and acceleration. Selection has two variants: eugenic, originally proposed by Plato; and selection for instruction, most commonly used in higher education, in which the unfit are simply denied admission or other opportunity. Both variants are potent enough, but for the many educators who do not wish to reject the unborn or the unfit, they are essentially conservative and defeatist.

Enrichment and acceleration are presently the most common strategies of instruction. Both models prescribe a series of activity units and tests and generally a final examination. Students move through the course of instruction in the same sequence. In most cases, students must repeat the entire course if they are judged to have failed. In enrichment programs, every student spends the same amount of time in learning, and individual variablity is evidenced in normally distributed test scores on unit and post-test criteria that correlate with measures of aptitude and environment. In sharp contrast, acceleration ideally means that the criterion is fixed and, as a consequence, time spent by each student varies. Some variants of acceleration are called "mastery learning." Both enrichment and acceleration, with their emphasis on units and elements, are well within the mainstream of Anglo-American psychology, more specifically that of E. L. Thorndike, J. B. Watson, and B. F. Skinner.

Two recent strategies of instruction employ diagnostic pretests to assess achievement before beginning instruction. The hierarchical model assumes that it is necessary to learn the elements of one unit of instruction before going on to the next and that some students have already mastered some units of instruction before beginning. A pretest serves, therefore, to place the student at the most appropriate point in the sequence of instruction. Progress is measured after each unit, and students who fail a unit must repeat it before proceeding to the next. The hierarchical model can be traced to continental notions of mental development by stages, although it does emphasize splitting up the subject matter.

The random model assumes that the elements of learning need not be presented in a particular sequence; some students, for instance, may need instruction in units A and C but not in B. Diagnostic pretests are given before instruction to determine which units to assign to students. The random model is Anglo-American in emphasizing elements rather than sequential or hierarchical structures.

Table 5

Classification of Constructs According to the Model of Educational Productivity

Theorist	Ability	Motivation	Quality of Instruction	Quantity of Instruction	Social Environment of Classroom	Home Environment	Peer Influence	Mass Media
Carroll (1968)	Aptitude Ability to comprehend instructions	Perseverance	Clarity of instruction Matching task to student characteristics	Opportunity to learn (time)				
Cooley and Leinhardt (1975)	General ability Prior achievement	Motivators (internal)	Motivators (external) Structure Instructional events Attitude toward teachers	Opportunity to learn (time)	Attitudes toward school		Attitudes toward peers	
Bloom (1976)	Prior achievement Reading comprehension Verbal IQ	Attitude toward subject matter Self-concept as learner	Use of cues Reinforcement Feedback and correctives	Participation in learning task (time)	Attitudes toward school			
Harnischfeger and Wiley (1976)	Pupil background	Intrinsic motivation	Teacher activities	Pupil pursuits (7 times categories)				
Bennett (1978)	Aptitude Prior achievement	Implicit	Clarity of instruction Task difficulty and pacing	Total Active learning time Quantity of schooling Time allocated to curriculum activity				

Table 5 continued

Classification of Constructs According to the Model of Educational Productivity[4]

Theorist	Ability	Motivation	Quality of Instruction	Quantity of Instruction	Social Environment of Classroom	Home Environment	Peer Influence	Mass Media
Gagne (1977)	Internal conditions of learning	Implicit	Activating motivation Informing learner of objective Directing attention Stimulating recall Providing learning guidance Enhancing retention Promoting transfer of learning Eliciting performance and providing feedback					
Glaser (1976)	Task learnings already acquired Prerequisite learnings Cognitive style Task-specific aptitudes General mediating ability	Implicit	Materials, procedures and techniques that foster competence (e.g., knowledge structures; learning-to-learn; contingencies of reinforcement) Assessment of effects of instruction					
Bruner (1966)	Task-relevant skills	Predispositions	Implanting a predisposition toward learning Structuring knowledge Sequence of materials Specifying rewards and punishments					

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[4] From Haertel, G.; Walberg, H.; and Weinstein, T.; "Psychological Models of Educational Performance: A Theoretical Synthesis of Constructs," Spring 1983. Copyright 1983, American Educational Research Association, Washington, D.C.

Multimodal and Multivalent Models

The multimodal model has several courses of instruction leading to the same achievement goals. Students are administered a pretest to determine their level of aptitude (for example, prior achievement, learning styles, and preferences), then assigned to the course of instruction presumed best suited to their aptitudes. The model assumes that aptitudes interact with educational treatments ("aptitude-treatment interactions") and many instructional strategies are based on this assumption, although nearly all research evidence for such interactions is negative. Multimodal instruction is a recent ramification of Anglo-American psychology in that it generally stresses elementist criteria of learning.

The multimodal model assumes (or is based on the value judgment) that not only should there be different sequences of instruction but that they should lead to different goals for different students. Harvard Project Physics, a high school course in the United States, was based on these premises. Different teachers and students were enabled to pursue different goals in physics, mathematics, or the nature and history of scientific methods. To permit cooperative planning, both teacher and student guides describe course organization, objectives, and alternative instructional strategies. The multivalent model grew out of continental psychology through the writings of Piaget and Bruner.

Acceleration, random, hierarchical, and multimodal models are complicated and require a large base of data and rapid feedback for assigning students to appropriate instruction. Thus, they depend on reliable, valid, and efficient testing and monitoring as well as an effective system for quick summary of data for decision making. The continuing persuasiveness of enrichment models in contemporary schools, despite alternatives advocated by theorists, may, indeed, be attributable to the lack of sophisticated management systems for instruction, a problem that someday may be solved by computer applications (Walberg 1983).

Grouping for Instruction

Models or strategies that employ individual, small-group, and large-group organization make different assumptions about the nature of learners. Individual grouping assumes that students learn according to their own aptitudes, rates, or styles. Small-group instruction assumes that subgroups of students sharing the same levels of aptitude or other characteristics may be identified to increase learning efficiency. Large-group instruction assumes that all students in the group share the same levels of aptitude. Such instruction may be easier for the teacher to supervise using conventional strategies; small groups may foster cooperative skills; and individual pacing, if efficiently adapted to each student's needs, may, in principle, provide the most efficient learning.

The foregoing models raise a number of conceptual and practical questions concerning teaching strategies. However tentative, they sharpen a number of instructional issues and identify the psychological assumptions implicit in current programs of instruction as well as in prototypical programs and management systems now being developed.

Control of Instruction

This section discusses four major strategies that pertain to the relative contributions of the teacher, the child, and instructional materials to the control of the scope, goals, pace, sequence, and means of instruction. The four strategies are: laissez-faire instruction, authoritarian or direct instruction, programmed instruction, and open education.

Laissez-faire instruction. The laissez-faire strategy reflects a low contribution on the part of the teacher and a high contribution on the part of the student. This permissive strategy reflects the convictions of the educational descendents of Rousseau. The romantic ideal of the university student of the late 1960s as a "noble savage" and radical youth movements around the world are extreme cases of the laissez-faire approach.

Direct instruction. Direct instruction is exclusive control of instruction by the teacher. The teacher is a strong leader who directs student activities and leaves little opportunity for students to select learning tasks or take part in decisions. The direct instruction pattern refers to a dominant leader who chooses all classroom activites and functions in a direct, businesslike manner. Brophy and Putnam (1979) suggested that authoritative teachers produce higher levels of achievement than do authoritarian teachers who are insensitive to student needs or permissive teachers who leave learning largely to the child. However, the research has not been definitively assessed on this important point. Peterson (1979), for one, has argued that greater student independence and autonomy may be fostered by greater teacher-controlled delegation of responsibility to students.

Programmed instruction. In this instructional strategy, neither the teacher nor the student has much control. A fixed curriculum and related instructional materials dominate the teacher (if any), the student, and the learning process. Programmed instruction uses written materials in which instructional elements are presented in units or "frames." Each frame requires a response from the student, and the length of the frame, varying from a short paragraph to several pages, is designed to suit the abilities of the typical student. Programmed materials may enable students to skip material they already know, to "branch" to needed correctives, and to proceed at a suitable, individual pace. In a summary of several reviews, Walberg, Schiller, and Haertel (1979) indicated that programmed instruction produces consistently favorable effects compared to traditional classroom procedures on achievement and interest in the subject, even though use of programmed instruction is declining. Computer-assisted instruction may incorporate some of the best features of programmed instruction and greatly increase educational efficiency in the coming decades.

Open education. Open education grew from practical experience rather than a philosophical or scientific foundation. Although writings on the subject occasionally mention Freud and Piaget, open education is not a theory or system of education but a related set of ideas and methods. Content analysis of major writings on open education reveals that the movement reflects the educational thoughts of Rousseau and Tolstoy, the progressive ideas of Deweyan educators of the 1920s and 1930s, as well as pedagogical methods used in the one-room prairie schoolhouses of nineteenth-century America. Open education is antipathetic to a line of mainstream Anglo-American education that classifies curricula into subjects, groups learners by ability, and views knowledge as represented authoritatively by the teacher or in prescribed, vicarious materials of instruction. Open education is more consonant with continental structural psychology and with some parts of the American clinical and developmental psychologies than with the psychologies most influential in twentieth-century American education—connectionism, behaviorism, and psychometrics.

Because it is founded upon contingency and uniqueness, open education resists characterization by the behavioral scientist's strategy of putting concepts into operation. In open education, each student, teacher, and event is regarded as unique. The feelings and behavior of teachers in open education cannot be easily categorized because the guiding principle is to respond as sensitively and reflectively as possible to the unique child at precise moments in the temporal stream and situational gestalt. Also implicit in this approach is a view of children as significant decision makers in determining the direction, means, and pace of their education. Open educators hold that the teacher and the child, in complementary roles, should together fashion the child's school experience. Thus, open education differs from teacher-centered and programmed, textbook, or other materials-centered approaches in that both the teacher and the child determine learning goals, materials, and activities.

Horwitz (1979) first synthesized about 200 comparative studies of open and traditional education by tabulating vote counts by outcome category. Although many studies yielded nonsignificant or mixed results, especially with respect to academic achievement, self-concept, anxiety, adjustment, and locus of control, more positive results were found in open education on attitudes toward school, creativity, independence, curiosity, and cooperation.

Peterson (1979) calculated effect sizes for the 45 published studes. She found about -.1 or slightly inferior effects of open educaton on reading and mathematics achievement; .1 to .2 effects on creativity, attitudes toward school, and curiosity; and .3 to .5 effects on independence and attitudes toward the teacher.

Hedges, Giaconia, and Gage (1981) synthesized 153 studies, including 90 dissertations, on open education. The average effect was near zero for achievement, locus of control, self-concept, and anxiety; about .2 for adjustment, attitude towards school and teacher, curiosity, and general mental ability; and about .3 for cooperativeness, creativity, and independence.

Despite the differences in study selection and synthesis methods, the three studies converge roughly on the same plausible conclusion: Students in open classes do slightly or no worse in standardized achievement and slightly to substantially better on several outcomes that educators, parents, and students value highly.

Giaconia and Hedges (1982) took another constructive step in the synthesis of open education research. From the prior effect-size synthesis, they identified the studies with the largest positive and negative effects on several outcomes to differentiate more and less effective program features. They found that programs that are more effective in producing the nonachievement outcomes—attitude, creativity, and self-concept—traded academic achievement on standardized measures.

These programs were characterized by an emphasis on the role of the child in learning, use of diagnostic rather than norm-referenced evaluation, individualized instruction, and manipulative materials, but lacked three components sometimes thought essential to open programs: multi-age grouping, open space, and team teaching. Giaconia and Hedges speculated that children in the most extreme open programs may do somewhat less well on conventional achievement tests because they have little experience with them. At any rate, it appears from the two most comprehensive syntheses of effects that unless they are radically extreme, open classes on average enhance several nonstandard outcomes without detracting from academic achievement.

Empirically-Based Teaching Strategies

During the last few decades, several researchers reexamined the grade strategies or models of instruction and focused on dimensional behaviors in teaching. Some of this research has been alluded to as the studies relate teaching behaviors and the student products or outcome measures. Although some of these studies retain some of the features of the grade strategies, they are generally more empirically based. This section discusses two teaching strategies that have been identified as a result of these empirically-based studies: *viz.*content-bound and content-free strategies (Smith 1976). Content-bound strategies primarily concern ways of interacting with the content of instruction, while content-free strategies focus on the instructions between teachers and pupils. Smith maintains that both types of strategies are essential in the teaching process.

Content-bound strategies. Several of the initial empirical approaches to identifying teaching strategies concerned teachers' verbal behavior. The research assumes that teaching is primarily verbal (i.e., spoken and written discourse and symbolic expression). As an outgrowth of their research on logical operations in teaching, B. Othanel Smith and his colleagues (1967) identified teaching strategies as large maneuvers that control the subject matter of instruction. Tactics are the means by which the subject matter is manipulated and controlled from moment to moment, while strategies are the ways by which the teacher frames or controls the general direction of student behavior (Smith 1976). Strategies direct student behavior toward selected outcomes. According to Smith et al. (1967), "strategies may serve to induce students to engage in verbal exchange, to ensure that certain points in the discourse will be made clear, and to reduce the number of irrelevant or wrong responses as the students participate in discussion, and so on" (p. 49).

Dunkin and Biddle (1974) summarized and reviewed interesting findngs about sequential strategies. Nuthall (1968) compared, as an illustration, four alternative concept-teaching sequences of conceptual moves for the teaching of two sociological concepts to high school pupils. He found that the effectivenss of a teaching strategy depends on the extent to which it makes use of, or interacts with, students' previous knowledge. He also found that descriptive and instantial moves are more effective than comparative moves. The teacher's sequencing of ideas is an important strategy for further investigation.

Content-free strategies. The conclusions of the reviews of process/product research of the past decade have been translated into many specific teaching strategies. For example, Gage (1978) summarized seven strategies or "teacher-should" statements for third grade teachers seeking to maximize reading and mathematics achievement:

1. Teachers should have a system of rules that allows pupils to attend to personal and procedural needs without having to check with the teacher.
2. Teachers should move around the room a lot, monitoring seatwork and communicating an awareness of pupils' behavior, while also attending to their academic needs.
3. When pupils work independently, teachers should ensure that the assignments are interesting and worthwhile, yet easy enough to be completed by each child without the teacher's direction.
4. Teachers should keep to a minimum such activities as giving directions and organizing the class for instruction. Teachers can do this by writing the daily schedule on the board, ensuring that pupils know where to go, what to do, etc.
5. In selecting pupils to respond to questions, teachers should call on a child by name before asking the question as a means of ensuring that all pupils receive equal opportunity to answer questions.
6. With less academically-oriented pupils, teachers should always encourage some response to questions. Rephrasing, giving cues, or asking a new question may help bring forth an answer from a reticent pupil, one who says "I don't know," or one who answers incorrectly.
7. During reading-group instruction, teachers should give a maximal amount of brief feedback and provide fast-paced drills. (p. 39)

These strategies are consistent with the conclusions of other process/product reviews and suggest a task-oriented, direct instructional approach to teaching to maximize cognitive gains.

Management and Cooperation

Another set of instructional strategies derived from process/product studies deals with preventive classroom management (Kounin 1970). Brophy and Putnam (1979) suggested that teachers avoid the extremes of authoritarian and permissive strategies and work toward a controlling but authoritative style that stems from both knowledge of the subject and of student interests. Kounin (1970) suggested several successful classroom-management strategies:

> developing a non-satiating learning program; programming for progress, challenge, and variety in learning activities; initiating and maintaining movement in classroom tasks with smoothness and momentum; coping with more than one event simultaneously; observing and emitting feedback for many different events; directing actions at appropriate targets; and maintaining a focus upon the group. (p. 144-5)

As previously discussed, two research syntheses show close agreement with respect to the positive effects of cooperative learning (Johnson et al. 1981; Slavin 1980). Johnson (1981) discussed a set of cooperative adult-child and peer strategies to facilitate achievement of educational goals. His review concluded that peer relationships in the classroom influence achievement, educational aspirations, values, attitudes, and other social and psychological behaviors. He also pointed out that student cooperation facilitates academic achievement, motivation, engagement, acceptance and support by peers, and divergent thinking. Further, he found that cooperative management of controversy or conflicts over ideas and opinions during instructional acitivities promotes achievement, curiosity, accuracy of cognitive perspective taking, problem solving and decision making, and creativity.

Thus, teaching may be analyzed from the perspective of content-bound strategies or from the perspective of ensembles of specific skills, behaviors, and activities (content-free strategies). In accord with Dunkin and Biddle (1974), it appears that research on content-bound strategies has produced relatively little evidence that would allow educators to pursue such teaching strategies. On the other hand, the research on content-free teaching strategies has provided a solid body of evidence that suggests specific strategies classroom teachers may employ to promote student learning.

Strategies for Educating Teachers

Several general strategies focus on how teachers learn teaching skills and strategies. For example, Joyce (1978) urged teachers to acquire strategies by first studying theories of strategies, then seeing them demonstrated, practicing their parts, synthesizing them in further practice, and finally applying them in the classroom (p. 81). Joyce's work was based on an assumption that teachers need several teaching strategies because all students do not generally learn from a single one.

Joyce and Harootunian (1967) indicated that "the reason the teacher must possess a range of teaching strategies is simply because different patterns of teaching behavior are useful for different educational purposes, and every teacher seeks educational ends that demand more than one way of teaching" (p. 94). Borg and his colleagues (1970) demonstrated that minicourses and other staff development techniques may help teachers learn complex skills and strategies. Butcher (1981) also found that microteaching has significant and consistent effects on the performance of secondary and elementary education students.

Systems of Education

Just as teaching strategies are ensembles of skills or behaviors, systems of education such as Individually Guided Education and Individually Prescribed Instruction (Talmage 1975; Glaser 1976) focus on teaching strategies and other educational components. Because of the cognitive, emotional, and behavioral demands of teaching, advanced strategies are difficult to implement and maintain in conventional schools. However, complex systems of educational management and support make it possible to carry out sophisticated individualized and cooperative strategies to increase both learning and socialization.

One comprehensive modern, and efficient system that addresses such goals is the Adaptive Learning Environments Model developed at the Learning Research and Development Center at the University of Pittsburgh (Glaser 1977; Wang 1980, 1983). The model combines materials and procedures for staff development, team teaching, and individualized and cooperative small-group learning with extensive student choice, peer tutoring, teacher-prescribed lessons for basic skills, and management and support components. The model brings together strategies such as acceleration and open exploratory learning discussed in previous sections of this article. The developers based the model on advanced psychological research and employed extensive evaluation of both the individual components and the system as a whole.

Prospects

Researchers and educators must retain both open-mindedness and skepticism about research synthesis. Yet the present does seem a period of quiet accomplishment in research on teaching. In a short time, research synthesis has helped sort what is known from what remains to be known about the means and ends of education.

Agriculture, engineering, and medicine made great strides in improving human welfare as doubts arose about traditional, natural, and mystical practices, as the measurement of results intensified, as experimental findings were synthesized, and as their theoretical and practical implications were coordinated and vigorously implemented and evaluated. Education is no less open to humanistic and scientific inquiry and no lower in priority: Half the workers in modern nations are in knowledge industries, and the value of investment in people is more apparent now than ever (Walberg 1983). Although more and better research is required, synthesis points toward improvements that seem likely to increase teaching effectiveness and educational productivity.

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Recent Classroom Research: Implications for Teacher Education*

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Introduction

Recent classroom research has been productive, bearing important implications for teacher training if the findings are used appropriately. Research yields concepts that enable us to describe and order classroom phenomena more fully. These concepts, as well as information about empirical relationships, are valuable when they allow practitioners to reflect upon what they do and when they encourage teachers to consider taking actions other than those past experience dictates. Research findings are misused when they are interpreted as answers to educational problems.

Much of this report is based upon work that my colleagues and I have presented elsewhere. In two papers (Good 1982a, in press), I presented some of the general findings from recent teacher-effectiveness research. In a recent book, my colleagues and I discussed a mathematics-research program that described teacher-effectiveness work in the area of mathematics education (Good, Grouws, and Ebmeier 1983). Other papers (Good 1982b; Good and Hinkel 1982) contained information about general classroom research and its relation to policy issues. Obviously, it is impossible to discuss related ideas without repeating arguments and observations presented elsewhere.

As I have cautioned elsewhere (Good 1982a), we must acknowledge that describing and affecting classroom learning is an enormously complex task. We should be suspicious of simple models of teaching that offer universal solutions to classroom problems. Recent observational research demonstrates that classrooms differ significantly, and that instructional problems vary from classroom to classroom. For example, observational data suggest that some classrooms are "undermanaged" while others are "overmanaged." Encouraging all teachers to increase time on task or to structure classrooms more would lead to inappropriate behavior in some teachers (those who have an appropriate degree of structure) and perhaps to lower student achievement.

Blind application of research findings must be discouraged, not only because the nature of problems varies from class to class, but because our knowledge about classroom processes and conditions that facilitate achievement is limited. We have much to learn about the forces that influence classroom thinking, behavior, and outcomes. For example, we know little about conditions associated with achievement in subject areas other than basic skills, and have virtually no consistent, reliable data concerning how to stimulate students' affective growth. Thus, although I am encouraged by recent progress achieved by classroom researchers, I am equally impressed by the complexity of the classroom setting and by the unexamined questions confronting classroom research and practice.

Still, we know considerably more about classroom teaching now than we did a decade ago. In 1973, our information about the effects of classroom conditions on student achievement was weak and contradictory. In the ensuing ten years, the literature on basic skills instruction, especially in reading and mathematics, has moved from a state of confusion through several successful field experiments. These studies have illustrated that teacher behavior can be causally related to student behavior and that teacher behavior can have important, practical effects upon student achievement.

Teacher Expectations

Much of the research conducted in the 1970s consisted of classroom observational studies aimed at determining what teachers do in interactions with high- and low-achieving students. The extent to which teachers differentiate in their behavior toward students has been found to represent an individual difference variable, with some teachers varying their behavior more than others (Brophy and Good 1974; Cooper and Good 1983).

Although the causes of differential interaction remain undefined, it is clear that many teachers vary sharply in their interaction patterns with high- and low-achieving students. Brophy and Good (1974) estimated that about one-third of the classroom teachers observed in related

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research have shown patterns of highly differentiated behavior toward high and low achievers. Teachers differentiate their behavior toward students they perceive as high or low achievers in a variety of ways (for a comprehensive discussion of these variables, see Good and Brophy 1978, in press): (1) calling on lows less often to answer classroom questions or to perform demonstrations; (2) waiting less time for lows to answer questions; (3) praising lows less frequently than highs after successful responses; (4) criticizing lows more frequently than highs for incorrect responses; and (5) not staying with lows in failure situations (providing clues, asking follow-up questions).

It is important to examine the implications of such teacher behaviors for low achievers. Because such an instructional system discourages students from taking risks, it seems that a good strategy for slow students who face such conditions would be to refrain from volunteering or responding when called on. To the extent that students are motivated to reduce risks and ambiguity—and many argue that students are strongly motivated to do so (see Doyle 1979)—it seems that students would become more passive in order to reduce the risk of public failure.

One cause of differential behavior is that classrooms are busy, complex environments; it is difficult for teachers to assess accurately the frequency and quality of their interactions with individual students.

A second explanation involves the fact that much classroom behavior must be interpreted. Research (e.g., Anderson-Levitt, in press) suggests that once a teacher develops an expectation about a student (e.g., the student cannot learn), the teacher interprets subsequent ambiguous classroom events in a way consistent with the original expectation. Good (1980) maintained that most classroom behavior is ambiguous and subject to multiple interpretations.

A third reason why teachers differentiate more or less in their behavior toward high- and low-achieving students involves causality. Some teachers believe that they influence student learning (for example, see Brophy and Evertson 1976). Such teachers may interpret student failure as a need for more instruction, more clarification, and eventually for increased opportunity to learn. Other teachers, because they assign blame rather than assume partial responsibility for student failure, may interpret failure as a need to reduce both challenges and opportunities to learn. Teachers who lack a strong sense that they influence student learning are therefore more likely to overreact to students' errors and failures than are teachers who feel that they do influence student learning and are a partial cause of student failure when it occurs.

Another explanation for differential teacher behavior is student behavior. Students present themselves to teachers in different ways and these self-presentation styles may influence teachers' responses. Spencer-Hall (1981) noted that some students time their misbehavior in such a way as to escape their teachers' attention, whereas other students who misbehave just as often are reprimanded more frequently because the timing of their misbehavior is inappropriate. According to Green and Smith (in press), the language some students use influences teachers to underestimate their potential. These researchers reported that teachers use linguistic performance as one basis for evaluation of students' performance. Thus, students must know academic information as well as how (and when) to display academic knowledge. Accuracy is not enough; students must present information in appropriate ways and at appropriate times. Because of linguistic deficiencies or lack of awareness of social cues, some students may have more difficulty convincing teachers that they know the material than do other students.

I have suggested several reasons why teachers behave differently toward high- and low-achieving students: the *complexity* of the classroom; the *ambiguous* nature of students' performance; teachers' beliefs about *causality* (their ability to cause or influence student performance); and *students' behavior*. Obviously, these are dynamic influences, and they often occur in combination. For example, Confrey and Good (in progress) noted that in one class, students were placed in either a high- or low-mathematics group on the basis of their teacher's interpretation of the students' performance during the first weeks of mathematics class. Assignment of students to the high group was based in part upon the speed with which they performed mathematical tasks.

Ironically, a week of observation indicated that students in the low group often watched what the teacher was doing in the high group. In interviews, the low-group students said that they observed the highs because they wanted to get ahead and learn what the high group was learning. Unfortunately, because the lows spent time watching the other group rather than doing their own seatwork, they produced incomplete seatwork assignments, thereby reinforcing the teacher's expectations and supporting the belief that the assignments to high and low groups were correct. Students' interpretations of their classroom roles and their behavior influenced and maintained teachers' expectations and behaviors.

Recent research suggests that teachers vary widely in their reactions to students' problems, and this variation may make it difficult for students to understand what is expected of them. As noted above, studies show that some teachers criticize low achievers more frequently than highs per incorrect response and praise lows less than highs per correct response. In contrast, other teachers praise marginal or incorrect responses by low achievers. These findings suggest two types of teachers: Teachers who criticize lows for incorrect responses seem basically intolerant of these pupils. Teachers who reward marginal or even wrong answers are excessively sympathetic and unnecessarily protective of lows. Both types of behavior illustrate to students that effort and classroom performance are not related (Good and Brophy 1977). Over time, such differences among teachers in the way they praise and criticize may reduce low students' efforts and contribute to passivity.

Clearly, teachers can expect too much or too little in their instruction of students. This problem must be addressed by policy makers as well as by curriculum specialists who write textbooks. In many instances, teachers need to assign different types of material to high and low achievers. Teachers can make instructional mistakes by treating students too much alike or too differently. However, we believe that, in general, evidence suggests that teachers are more likely to expect too little from students whom they perceive as having limited ability. (In *Looking in Classrooms* (1978, in press), Jere Brophy and I reviewed in detail research findings and concepts associated with teacher-expectation effects and discussed our beliefs about how teachers may deal with high and low achievers in the same classroom. The interested reader may obtain a more detailed statement of the problem therein.)

Policy Implications of Teacher-Expectation Research

Teachers should understand the ways in which teachers vary their behavior inappropriately when interacting with low achievers in contrast to how these same teachers behave with students they believe to be more capable. Observational studies suggest that the problem varies from classroom to classroom. Hence, universal rules, such as increasing wait time for lows, may do more harm than good: Some teachers are already waiting appropriately; a further increase in wait time might prove dysfunctional.

As I have pointed out elsewhere (Good, in press), since the variables that affect teaching and learning are numerous, complex, and interrelated, knowledge of concepts related to teacher-expectation effects is best combined with judgmental and decision-making skills about how those concepts may be appropriately used, rather than presenting teachers with a list of behaviors to perform routinely. Knowledge of expectation effects should be combined with extensive knowledge of how children learn and develop.

Many classroom teachers appear to lack formal methods of monitoring their interactions with different students. In short, they lack a model for examining their behavior for expectation effects. It would seem, then, that one of the goals of teacher education should be the development of models for thinking about expectation phenomena.

Evidence indirectly indicates that lows receive more varied classroom teaching behavior than do highs. It seems plausible that part of the variation is due to teachers' lack of agreement about how to respond to students' failures. Teacher education programs could play a valuable role by helping prospective teachers understand that some failure will exist in any teaching situation (learning occurs in stages and reteaching is often necessary). Programs should develop teachers' skills to allow them to interpret failure as a challenge and should provide teachers with better strategies for responding to failure.

In particular, teacher education programs must create role definitions specifying that the teacher is there primarily to teach, that failure calls for reteaching rather than rationalization. Methods classes should stress diagnosis and remediation following failure. Teacher education programs need more emphasis upon adapting instruction after initial teaching. Too much orientation tends to suggest that learning is nonproblematic if certain methods are faithfully applied. If anything, observation of teaching shows that learning is very problematic (e.g., students interpret the same teacher behavior in different ways), and that teachers need greater tolerance and understanding in dealing with students when success is not immediate.

Because the literature on teacher effectiveness was dismally weak in the late 1960s through the mid-1970s, it is possible that many training programs devised in those years erode teachers' motivation by stressing the difficulties associated with teaching. In other institutions, graduating teachers may suffer from a different problem: unrealistic optimism about their ability to motivate students.

Teaching seems a tough, demanding, but doable job (Good and Brophy 1980). Unrealistically high or low expectations about teaching or teachers' ability to influence low achievers, in particular, may have subtle effects upon teachers' classroom behavior. However, at present, virtually no information exists about the expectations of beginning and graduating teachers, particularly about the expectations they hold for teaching or for improving the performance of low-achieving students.

Teacher-Effectiveness Research: Active Teaching

Concern about what teachers actually do in the classroom has led many researchers to study how teachers interact with high- and low-achieving students. An incidental outcome of this research has been the demonstration that teachers vary greatly across classrooms in their behavior, as well as in how they distribute time and resources within classrooms. Teachers have been found to vary widely in the type and quantity of questions they ask pupils, the time they spend presenting new material versus reviewing, the time they spend on general recitation versus seatwork, and how they organize classrooms for instruction (whole class, individualized, small groups). The discovery of such variations in structure and behavior led many investigators to become interested in the variations' impact upon student achievement and behavior.

Readers interested in detailed information about the literature on whether or not individual teachers or instructional programs affect learning may find that information elsewhere (Brophy 1979, in press; Rosenshine, in press). However, I want to emphasize that recent teacher-effectiveness research has provided clear evidence that individual teachers do make a difference in student learning. I will briefly illustrate the value of recent teacher-effectiveness research by discussing the program of research that Douglas Grouws and I coordinated at the University of Missouri-Columbia (for more details about this research see Good, Grouws, and Ebmeier 1983).

Our initial research on this problem began with a sample of more than 100 third and fourth grade teachers. We computed residual gain scores for each teacher during each year, using his or her students' pre- and post-tests. Looking at test scores over a three-year period, we found that teachers varied considerably in their impact on students' learning, despite the fact that they used the same textbook and in most cases taught comparable students. Our initial data demonstrated an apparent teacher effect. Some teachers produced much more mathematics learning than did other teachers in comparable settings.

We felt that observing teachers who had a stable and relatively high or low level of effectiveness would be an excellent basis for estimating the relative effectiveness of different teaching behaviors. Hence, our observational research focused upon teachers who were consistently high or low across several consecutive years in their ability to produce strong student performance on standardized achievement tests. We found that stable high and low teachers differed in their classroom behavior.

Within the constraints of our operational definition, more effective teachers, in contrast to less effective teachers, were found to (1) teach the class as a whole; (2) present information more actively and clearly in the development of the lesson (that part of the lesson in which teachers stress the meaning of the material); (3) be task focused (most of the period was spent on mathematics, not socialization); (4) be basically nonevaluative and create a relatively relaxed learning environment with comparatively little praise or criticism; (5) express higher achievement expectations (more homework, somewhat faster pace, more alerting); and (6) experience fewer discipline problems.

Although we were pleased with the naturalistic findings in that they provided some clear contrasts between relatively high- and low-gain classrooms, we felt it important to determine whether a more direct association could be established between the behaviors identified in our observational, naturalistic study and student achievement.

In particular, we wanted to see if we could instruct teachers to behave in ways consistent with the behavior of effective teachers and determine what, if any, impact such behavior would have on student achievement. Because of the expense involved in field testing, we wanted the study to be as comprehensive as possible. Thus, in addition to including the contrast obtained in our earlier, naturalistic studies, we tested promising findings from other teacher-effectiveness studies. Writing the training program resulted in a 45-page manual for teachers. As pointed out elsewhere (Good and Grouws 1979), the program is a system of instruction: (1) instructional activity is initiated and reviewed in the context of meaning; (2) students are prepared for each lesson stage, enhancing involvement and minimizing errors; (3) the principles of distributed and successful practice are built into the program; (4) active teaching is demanded, especially in the development of the lesson (when the teacher explains the concept being studied, its importance, etc.).

Pre- and post-testing with standardized achievement tests indicated that after two-and-one-half months of the program, the performance of students in experimental classrooms was considerably higher than the performance of those in control classrooms. In addition, experimental students reported significantly more favorable attitudes at the end of the experiment than did control students. Finally, it is important to note that anonymous feedback from teachers in the project indicated that they felt the program was practical and that they planned to continue using it. Research elsewhere has indicated that teachers have a favorable reaction to the program even when it is presented and discussed without the involvement of the developers (Andros and Freeman 1981; Keziah 1980). Also, research at the junior high level suggests that secondary teachers can implement the program with positive impact on certain aspects of students' mathematics achievement (Good, Grouws, and Ebmeier 1983).

Our research on mathematics instruction, especially at the elementary level, has convinced us that teachers do make a difference in student learning, and that inservice teachers can be trained in such a way that student performance is increased. The system of instruction we espouse may be broadly characterized as *active teaching*. In our work, active teaching was an important difference between teachers who produced good achievement gains and those who produced poorer-than-expected gains. Teachers whose students made greater gains were more active in presenting concepts, explaining the meanings of those concepts, providing appropriate practice activities, and monitoring those activities prior to assigning seatwork. The fact that these teachers appeared to look for ways to confirm or disconfirm that their presentations had been comprehended by students was particularly important. They assumed partial responsibility for students' learning and appeared ready to reteach when necessary.

In contrast, teachers who produced lesser gains tended to rely more on seatwork; often their students worked without a good conceptual understanding of what they were doing and why. In some cases, students did not receive adequate procedural instructions for seatwork, and teachers appeared to ignore signals from students indicating either procedural or substantive misunderstanding.

As pointed out elsewhere (Good, in press), this difference in active teaching across classrooms is comparable to differences found within classrooms in teacher-expectation research. That is, teacher-expectation literature reveals evidence that in some classrooms low-achieving students receive less active and less meaningful teaching than do high-achieving students. In our effectiveness research in mathematics, we found that some teachers are less active in teaching the entire classroom.

In addition to the results presented above, there have been a few other attempts to intervene experimentally in the teaching process to determine whether teacher-behavior changes and student achievement could be increased. An especially good review of four of these field experiments was provided by Gage and Giaconia (1980). The four experiments (Anderson, Evertson, and Brophy 1979; Good and Grouws 1979; Stallings, Needels, and Stayrook 1979; and the Stanford Program on Teacher Effectiveness 1978) were compared in terms of their instructional programs, degree of implementation, and impact on students. Gage and Giaconia noted solid evidence that indicates that it is possible to change teaching behaviors in desired directions through relatively inexpensive inservice teacher education programs. They noted that changes in teacher behavior have occurred in experiments with random assignment of schools and/or teachers to training conditions, and that the results show consistent improvement in student achievement. The reviewers have also noted that these four experiments differ considerably from previous educational experiments. In particular, the four experiments were conducted in regular classrooms; the instructional treatment had operated for an extended period of time; the experiments used practicing teachers, not student teachers; and the teaching behaviors manipulated were realistic in that other teachers already had been observed exhibiting the behaviors. The experiments thus had ecological validity because they advocated behaviors that other teachers had been able to exhibit in actual classrooms (Good 1979).

One important consideration is that in a variety of studies using the Missouri Mathematics Program, experimental groups have done better than related control groups. However, the magnitude and importance of the differences are more evident for some teacher-student combinations than for others. It is clear that certain combinations of students and teachers tend to do better using the treatment than do other combinations (Ebmeier and Good 1979). The effects of the program on some teacher-student combinations have been replicated by Janicki and Peterson (1981). It also seems that the classroom organizational structure interacts with the effects of the instructional treatment (Ebmeier, Good, and Grouws 1980).

Clearly, there is no single system for presenting mathematics concepts effectively. Some of the control teachers in our studies have obtained high levels of student achievement using instructional systems that differ from those presented in our program. More information is needed about the classroom contexts and particular combinations of teachers and students that make the program more or less effective.

It is satisfying to see that the instructional program we have developed (and those developed elsewhere) is a viable system that teachers willingly implement and that has positive influences upon student achievement. We now need to know more about why some teachers employ the system more fully than do others and about the types of local school features (including child characteristics and classroom structure) that lead to fuller implementation. In particular, we must study, both naturalistically and experimentally, mathematics teachers who use individualized and small-group practices more successfully than do other teachers.

Policy Implications: Teacher-Effectiveness Research

The concept of active teaching, an important aspect of effective teaching, has evolved from recent naturalistic and experimental research. The concept should be presented as a way of looking at and thinking about classroom teaching, not as a set of behavioral prescriptions.

Teachers who present information actively, pay attention to the meaning and conceptual development of content, look for signs of student comprehension and confusion, and provide successful practice opportunities appear to have more achievement gains than do teachers who are less active and who rely more upon seatwork and other classroom activities. Most of this research has been focused on elementary classrooms; however, reasonably consistent data exist in the area of secondary mathematics as well (e.g., Evertson, Anderson, Anderson, and Brophy 1980; Weber 1978).

I use the term *active teaching* rather than *direct instruction* (which has been used to describe the pattern of behavior of teachers who obtain greater-than-expected achievement from students) because the former represents a broader concept of teaching than does the existing research base. In active teaching, the initial style may be inductive or deductive; student learning may be self-initiated or teacher-initiated (especially if thorough critique and synthesis activities follow students' learning attempts). Active teaching also connotes a broader philosophical base (it may occur in classrooms using a variety of organizational structures) and should become somewhat less direct as students become more mature and instructional goals more focused on affective and process outcomes (Good 1979).

In short, while others prefer the term *direct instruction* because it relates more to actual research evidence, I prefer *active teaching* because it is a concept rather than a set of findings and thus appears more comprehensive. Active teaching finds application in both teacher-led instruction as well as in student-team learning and instruction (e.g., Peterson, Janicki, and Swing 1980; Slavin, in press; Webb 1977).

Active teaching provides an important construct for characterizing the teaching role. With the apparent growing pressure for teachers to function as classroom managers rather than as instructors, teacher education programs should place more emphasis upon helping teachers understand active teaching. As pointed out in the section on teacher-expectation policy issues, the development of this understanding should be in a decision-making context that helps teachers adapt the concept to particular types of content and students. (For a recent discussion of teacher-effects research and its practical implications, see Good and Brophy, in press.)

Classroom Management

In the 1960s, it was popular to view classroom management as classroom discipline; considerable emphasis fell on what to do *after* students misbehaved. A research paradigm initiated by Kounin (1970) and validated and expanded upon by a number of researchers in recent years has illustrated strongly that good classroom managers are not sharply different in terms of how they *react* to student misbehavior. Rather, the key behaviors that distinguish good classroom managers are techniques that *prevent* misbehavior by eliciting students' cooperation and involvement in assigned work.

Kounin (1970) tried to determine how effective teachers (teachers who had classes with relatively high engagement rates and infrequent discipline problems) managed classes in contrast to other teachers. He identified several variables that differentiated effective and ineffective managers. Attention here will be placed on six of his concepts: withitness, overlapping, smoothness, momentum, alerting, and accountability.

Withitness refers to the extent to which a teacher communicates awareness of student behavior. A basic, operational definition used by Kounin for measuring withitness was the ratio of the number of times the teacher stopped misbehavior appropriately (e.g., sanctioned the right student or stopped the misbehavior before it became more serious) to the total number of attempts to stop misbehavior.

Overlapping refers to a teacher's ability to deal with two or more issues at the same time. Kounin found that some teachers could deal with multiple events simultaneously, whereas others became too involved in one activity and neglected the other.

Smoothness is the teacher's ability to move through an instructional sequence without interrupting academic work by interjecting irrelevant information or by overresponding to disruptive behavior. An example of a lack of smoothness would be a teacher's request for a student to pick up a piece of trash during a group lesson, thereby delaying all students and breaking their concentration on the lesson.

Momentum refers to avoiding behavior that slows a lesson unnecessarily. Teachers who continue to complain about a student's behavior after he or she is back on task; those who slowly pass out work sheets one at a time; and teachers who dwell on academic topics longer than necessary all illustrate poor momentum.

Alerting behaviors are teachers' attempts to keep students engaged in tasks by telling them that their work will be examined or checked. Examples of alerting during recitation lessons include teachers' calling on students randomly, or reminding students that they may be asked to comment upon the responses of other students. During seatwork, the teacher may alert students by telling them that their work will be checked in a few minutes.

Accountability is defined as the extent to which teachers follow up on alerting behaviors. Do teachers actually ask students to respond to the answers of other students after alerting students to that possibility? From Kounin's standpoint, the purpose of alerting behaviors is to keep students involved (e.g., listening even though another student is responding), whereas accountability behaviors seek to assess students' performance (e.g., did they listen?).

Kounin found that withitness, overlapping, smoothness, momentum, alerting, and accountability were positively and at least moderately correlated with student involvement in classroom lessons. Kounin's (1970) basic findings have been expanded somewhat. For example, researchers have subsequently noted that teachers may alert or engage in accountability too much as well as too little. Fundamentally, however, Kounin's work has been consistently replicated and remains an important source of information about classroom management (see Brophy, in press, for additional information about management research).

More recently, Kounin and Gump (1974) studied 596 videotape lessons and found that teachers of more successful lessons (lessons that elicited higher student involvement) provided continuous, explicit cues for appropriate behavior and insulated students from external intrusions.

Emmer, Evertson, and Anderson (1980) studied 27 third grade teachers during the first week of school and throughout the year. The investigators attempted to identify teachers who had comparable classes at the beginning of the year but who differed in management effectiveness (degree of student involvement in lessons) during the year. The findings of this study suggest that the *form* of the management system is not as important as the *quality* with which it is implemented. The authors found that what distinguished the more effective managers was the degree to which rules and procedures were integrated into a workable system and how effectively the system was taught to students. Effective managers were superior primarily because of their clear expectations, commitment to teaching classroom routines, and systematic follow-through.

Evertson and Anderson (1979) reported that at the beginning of the year effective managers spent more time helping students behave appropriately. These teachers had carefully developed procedures for how students should get assistance, line up, and turn work in; they had firm general standards for classroom conduct and communicated this information to students. Some teachers had to teach this information daily, whereas effective managers taught it systematically only at the beginning of the school year. Although it seems a small point, it is amazing how much time teachers save by teaching simple routines and procedural expectations early in the year. Some teachers lose valuable instructional time every day by failing to build in managerial routines (consider, for example, the teacher who talks for five minutes at the start of the period to students who were absent the day before, thus neglecting the rest of the class).

Evertson and Anderson report that better managers were also more careful monitors of student behavior and dealt with misbehavior more quickly than did less effective managers. More effective managers alerted students to the behaviors they expected and held students accountable for those behaviors. To the extent that students internalized these rules, they could monitor their own behavior (e.g., they knew when and how to get help from other students about missed assignments). Internalizing norms for conduct and procedures not only makes the individual learner more efficient (for example by minimizing time spent wondering when or how to approach the teacher for feedback), it also minimizes the number of situations that demand overlapping teacher skills.

Researchers elsewhere have shown that more effective managers not only exhibit different patterns of behavior in their daily lessons (more withitness) but that they also vary from other teachers in how they initially structure the school year. In a study that compared how beginning teachers started the year with a group of "best" teachers (nominated by students), Moskowitz and Hayman (1976) found that good teachers spend more time setting expectations and establishing behavior patterns on the first day than did beginning teachers. However, "best" teachers were also more willing to use students' ideas than were beginning teachers. Hence, despite popular shibboleths to the contrary, teachers who are successful managers are not necessarily stern and rigid. They appear skillful in stating expectations and listening to and working with students to be sure that workable and understandable rules are established and enforced (workable and shared expectations are probably more important conditions than who initiates the rules). Simply put, these teachers teach norms for appropriate classroom behavior.

In general, research in secondary schools suggests a similar relationship between teacher behavior and student involvement. For example, in a study of how more and less effective junior high teachers started the year, Emmer and Evertson (1980) reported that better managers set clearer expectations for behavior, academic work, and classroom procedures during the first several class meetings than did less effective managers (although they needed less time for these tasks than did elementary school teachers). Furthermore, they found that good managers in junior high schools (as in elementary schools) monitored students and dealt with inappropriate behavior promptly.

Teachers who are successful managers start the year by establishing rules and procedures (some announce; some negotiate) and by communicating norms for classroom behavior. Other teachers, unclear about their behavioral expectations, spend much time attempting to clarify expectations. Students in these teachers' classes may spend considerable time wondering (sometimes justly so) whether their behavior is appropriate or not. In effective managers' classes, it is thus easier to know what is expected; it is easier for students and teachers to monitor behavior because they can distinguish appropriate from inappropriate behavior.

It is important that teachers who establish rules actively monitor and deal with inappropriate behavior (especially serious misbehavior). Effective managers may therefore sanction more behavior during the first three or four days of the year than do other teachers. Because students eventually begin to engage in fewer off-task behaviors, it soon becomes even easier for the teacher to monitor the class and to sanction behavior appropriately. Failure to follow up on inattentive, disruptive behavior suggests to students that the teacher is not serious about maintaining rules, thereby encouraging students to do as they please. Similarly, a teacher who consistently reprimands the wrong student (e.g., a student who did not misbehave or a student who joined in but did not initiate the misbehavior) indicates that he or she lacks the skills to maintain a management system: Why not misbehave if you're as likely to be sanctioned for misbehavior when attending to assigned tasks as you are when actually misbehaving? If teachers exhibit a lack of purpose or interest in maintaining a management system, it is likely that students will ignore rules much of the time.

If teachers establish reasonable and workable rules, expect compliance, monitor the class, and insist upon appropriate behavior when necessary, students will sense the teacher's seriousness about classroom management and will begin to internalize rules, expectations, and procedures.

In addition to establishing procedural and behavioral expectations, teachers must also demand that students use their time to complete curricular tasks. Effective managers assume that students will complete assignments and will hold students accountable for the work. Students know what to do when they finish assignments and do not waste time trying to determine the next step. That is, effective managers maintain classroom environments in which expectations for student behavior are *continuous*.

In some classrooms, teachers make it difficult for students (as well as teachers) to monitor their behavior. For example, following a demonstration lesson a teacher might assign seatwork but say, "If you work now you won't have homework." Such statements and expectations make students' role ambiguous: Presumably, students may do the work now or later. Hence, when students choose not to do seatwork, it is difficult to tell if their behavior is appropriate or inappropriate. Furthermore, there is the question of what these students will do while other pupils are engaged in seatwork.

In contrast, more effective managers are likely to shift from demonstration to seatwork in the following way: "Now you do problems 15 through 30 at your desks. In ten minutes, we will check to see what progress you have made and correct any problems we encounter. If you have difficulty with a problem, do the next one and I'll be around to help you. Get started now." Here the students' role is clear; under all conditions, students should attempt to do assigned work. If they encounter difficulty, they know to proceed to the next problem.

As Gail Hinkel and I emphasized elsewhere (1982), all of these aspects of management must be in place for the system to work. For example, teachers who build general credibility with students during the first few days of school, explicitly establish learning goals on a daily basis, and build in continuous criteria for helping students know what is expected of them at any given moment will nonetheless lose control of their classrooms if they do not check students' work regularly.

Doyle (1982) argued that accountability drives the task system and that students tend to take seriously only that work for which they are held accountable. I agree that accountability is important: Teachers must learn the importance of accountability and explore ways in which accountability may be handled creatively and constructively.

In essence, a good management system announces intentions and makes it possible to monitor actively teacher and student behavior to see if progress is being made toward goals. Such information increases the understanding of teachers and of students who are intrinsically motivated by school tasks concerning how to do well in the classroom. For students lacking academic motivation, a management system helps establish necessary conditions for learning self-control and for understanding that classroom rewards and privileges are associated with progress on assigned tasks. Without highly developed management skills, teachers rely on simplistic, routine assignments that merely elicit students' cooperation (Doyle 1982).

This description of effective management does not necessarily imply teacher control, although good management in the early school years may involve close teacher monitoring and frequent feedback. As students grow older, they should need fewer reminders of behavior standards. Still, students of all ages should understand what constitutes appropriate work and behavior. Students also need feedback about their progress on self-chosen goals as well as information about goals established by the teacher.

Good management skills provide a necessary—but not sufficient—structure for active classroom learning. Poorly managed classes inhibit students' involvement and negatively affect learning outcomes. The correlational evidence relating the management behaviors reviewed here to student achievement is consistent; the obtained relationships are typically at least moderate (Brophy, in press). Furthermore, growing experimental evidence shows that the managerial principles discussed above may be taught to teachers who can use them to improve students' attention to assigned work (e.g., Anderson et al. 1979; Brophy, in press; Good, Grouws, and Ebmeier, in press). An especially good review of recent research on classroom management, teacher effectiveness, and school effectiveness appeared in the May 1983 issue of *Elementary School Journal*.

Policy Implications of Management Research

Considering management research and the availability of materials for teaching managerial skills to teachers (Good and Brophy 1978, in press; Emmer et al. 1980), it is important that this information be conveyed to preservice (and inservice) teachers. It is not clear how widely current information about classroom management is known or disseminated by teacher educators. I find it surprising that many recent teacher graduates are unaware of concepts such as withitness and overlapping, which have been demonstrated repeatedly to be important in effective management. Teachers' unfamiliarity with these concepts is especially surprising when one considers that many teacher educators consider classroom management an important teaching task. My contacts with teachers from many different institutions support this view. It would seem that schools of education, as well as staff-development programs, need to integrate findings from management research into their academic curricula.

Although I advocate greater dissemination of management research, certain qualifications must be considered regarding the application of findings. First, effective managers in the research reviewed here *thought about* the needs of their students and *adjusted* their teaching to particular classes. These teachers appeared to be good decision makers. Although better managers seemed to build a communication system that helped students identify without direction how to respond appropriately in the classroom, Emmer et al. (1980) noted that they also had a sense of students' perceptions and needs. That is, in contrast to other teachers, effective managers first taught rules related to students' most immediate needs (e.g., where to put one's lunch box, how to obtain permission to use the bathroom, etc.). Effective managers were also more likely to consider appropriately the following factors in relation to lesson design: (a) attention span of students; (b) relation of lesson content to students' interests; (c) appropriate work standards; and (d) assurance of reasonably high levels of student success. Thus, it seems that, in addition to understanding management techniques, teachers must also possess a keen grasp of how students learn and develop.

Although existing research yields important, practical knowledge, we need more research to further understanding of how management strategies influence learning in various classroom contexts. The boundaries between instruction and management blur upon examination. The managerial or instructional issues that are important to teachers will vary, depending upon the subject matter and whether teachers pursue process or product goals. For example, to a teacher interested in students' achievement in mathematics, students' attentiveness and participation are largely managerial issues. From the standpoint of a social studies teacher pursuing process goals, the form of attentiveness and level of participation may be instructional issues.

This discussion is included to remind the reader that

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classroom management has traditionally been viewed as a product variable (e.g., maintaining student attention). Research has yielded important facts and concepts concerning management, but one must remember that other ways of viewing this variable have not been explored. Brophy (1979) advocated the study of instructional issues that are independent of classroom management. In order to do so, however, better definitions of management and instruction will be needed, and these issues should be studied both from process and product perspectives. In addition, future researchers must determine why some management strategies work and test specific theoretical arguments. Similar attention should be paid to why and how teachers observed to be effective developed their managerial strategies.

In particular, researchers should examine how teachers' classroom-management styles influence student initiative and self-control. Students need structure and purposeful direction, but they must also have opportunities to learn to determine their own objectives and to develop strategies for evaluating progress toward self-chosen goals. Such abilities become increasingly important as students get older.

Summary

The past decade has been a productive era for classroom research. Recent investigations have yielded useful concepts for thinking about classrooms and about facilitating achievement. Research findings and concepts provide a way of considering classroom instruction, but they are not rules for classroom behavior. A good example of the need to use classroom-research findings as tools rather than answers appears in Adams and Biddle's (1970) discussion of the "action zone." They found that students who sat in the middle-front-row seats and in seats extending directly up the middle aisle received more opportunities to talk in class than did other students.

Adams and Biddle's research suggested that there may be areas of a classroom where students receive more response opportunities than do students in other areas. However, interpreted too literally, this work suggests that teachers and classroom observers should pay most attention to what takes place in the front row and the middle of the class.

Data collected by Alhajri (1981) showed the utility of viewing the action zone as a concept rather than a generalized phenomenon. In 32 classrooms, the investigator found only one class that had an action zone like that described by Adams and Biddle; however, Alhajri found many classrooms with some kind of action zone. If observers or teachers monitored classes for only one type of action zone, they would miss the action zones present in these classrooms.

I argued earlier that some teachers believe (and behave accordingly) that they have little effect on students' learning. In fact, many teachers cannot simply and directly explain what they attempt to accomplish in their classrooms. Teacher training institutions need to give more attention to how their students perceive the role of the teacher and help teacher candidates develop a coherent teaching philosophy before they enter the classroom. Teachers who are confused about their role and goals and who hold low expectations for their classroom performance are unlikely to positively affect student learning and development.

Recent research provides clear evidence that teachers do have important effects on students' performance. Furthermore, these studies provide important concepts for thinking about classroom teaching. Such information is useful for teachers who have a sense of purpose and who have been trained as decision makers. These teachers will not use information mechanically but rather will integrate recent classroom research with their knowledge of student development and learning, and thus apply information intelligently in their particular settings.

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Context Effects in the Teaching-Learning Process

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Improving our understanding of the teaching-learning process will require examination of more than simple, classroom, process-pupil outcome relationships, which have been the major focus of past work. Research on those relationships has been fruitful: It has established principles of effective teaching that have been validated in true experiments and found to change both teaching behavior and student learning (Gage and Giaconia 1981). But good teachers have always known that the same teaching behaviors have different effects on different pupils, and that attaining different objectives requires different styles of teaching.

As early as 1969, Cronbach and Snow commented ". . . the search for generally superior methods must be supplemented by a search for ways of adapting instruction to the individual." (Dowaliby and Schumer 1973, p. 126). Dunkin and Biddle (1974) proposed that recognition of context effects would both clarify and bring greater power to results on effective teaching. Such research followed, and the topic now is the focus of a considerable and growing body of work, carried out both by researchers studying what are called aptitude-treatment interactions (ATI studies) and by teacher-effectiveness researchers interested in the differential effects of teaching on different students.

Dunkin and Biddle (1974) defined *context* as ". . . the conditions to which the teacher must adjust—characteristics of the environment about which teachers, school administrators, and teacher-educators can do very little" (p. 41). However, we have chosen to use Webster's (1975) definition, which is somewhat broader:

> CONTEXT . . . weaving together of words. fr. L. *contextus* connection of words, coherence. fr. *contextus*, pp. of *contexere* to weave together, fr. *com* + *texere* to weave . . . 1: the parts of a discourse that surround a word or passage and can throw light on its meaning 2: the interrelated conditions in which something exists or occurs . . . . (p. 245)

For this paper, we will use the term *context* to include clarification or modification of relationships between classroom process and pupil outcomes. There seem to be three points at which this occurs:

1. Identifying aspects of the process measure (classroom behavior) that have not usually been distinguished but which relate differently to pupil outcome.
2. Taking account of pupil characteristics that change the relationship between process and outcome.
3. Identifying groupings of outcome measures that relate differently to a classroom behavior.

While taking account of these context variables has potential for making research results clearer and more powerful, and for making teaching more effective with more students, we still have a problem. Even though research of this sort has been carried out relatively infrequently we already have volumes of findings that are difficult to interpret and that would be impossible for a teacher to apply. We have, literally, an embarrassment of riches—or perhaps an extensive collection of what Biddle has described as "isolated curiosities." Possible ways of dealing with this problem are to identify those context variables that appear most powerful in identifying differences in pupil outcomes, or those that are best replicated, or those that, although apparently diverse, may be integrated to propose principles of teaching. All of these will be attempted, and the problem will become one of walking a fine line between ignoring some of these findings and being inundated with complexity.

Several further caveats apply: The major focus in this paper will be on teacher-effectiveness research rather than ATI studies; we will deal primarily with classroom management as broadly defined; and we will rely primarily on work using low-inference or "counting" measures of classroom process. Finally, for simplicity, we will sometimes state interpretations as though causal relations had been established, but it should be recognized that such a relationship is seldom the case. Most findings are based only on relationships.

Differentiating Aspects of Process

In an early project (Soar 1966), we obtained a result that

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was perplexing at the time but that now makes sense by a more refined way of thinking about teacher control in the classroom. The finding was the contrast in results for two measures of teacher control as they related to pupil gain in creativity using some of Torrance's (1962) measures. Teacher indirectness as measured by Flanders's (1970) Interaction Analysis—teacher acceptance and use of pupil ideas in classroom discussion—showed a relatively strong, positive relationship. But another measure that reflected freedom of movement of pupils in the classroom showed a relatively strong, negative relationship. That is, freedom of pupil idea production was related positively but freedom of physical movement was related negatively. We had expected freedom, as such, to promote gain in creativity. We concluded at the time that creativity gain also involved discipline, but that conclusion did not sit comfortably with us. Now it does.

Teacher Control Structure

What is being controlled? One distinction that seems to help in understanding the relation between classroom control and pupil learning is the distinction between teacher control of pupil behavior and teacher control of learning tasks (Soar and Soar 1979). Pupil behavior in this sense refers to such things as physical movement, socializing, and subgrouping—the nonsubstantive activity in the classroom. Teacher control of learning tasks refers to such things as where the problem came from on which pupils are working: Did the teacher import it intact, or did pupils have some voice in choosing or shaping it? Were the materials prepackaged, or do pupils search for and select them? Who evaluates the activity—does the teacher do that single-handedly, or do pupils have a role? This distinction between behavior and learning activity seems obvious today, but part of the process of research has been learning what to measure, a distinction that is not widespread, although Brophy and Evertson (1974) and Stallings and Kaskowitz (1974) have coded instructional interaction separately from management interaction. It is also clear that teachers in general do not make this distinction. In one of our studies, control of behavior correlated in the 70s with control of learning activity; in another study, the correlation was in the 80s. Apparently, if the typical teacher controls behavior closely, he or she also controls learning tasks closely; if he or she frees one, he or she frees both. But research findings suggest that this parallelism does not function for greatest pupil learning.

Control of behavior. In our data, teacher control of behavior was related positively with achievement gain: The less freedom of behavior pupils had, the more they learned. Further, in a study in which we distinguished task-related movement from that which was not task related, the relationship was about equally strongly negative for both measures. Further, when we analyzed for diminishing returns, asking if there was a point beyond which greater control would not produce greater gain, we found no evidence. We are not comfortable with this result; there must be a point beyond which the classroom becomes like a prison for children. It may be that the teachers protected us from this result by not establishing such extreme conditions. It should be remembered, too, that this conclusion has to do only with achievement gain. Probably other outcomes, such as independent, self-directed behavior by pupils, would produce a different result. But the finding seems relevant for at least some portion of the classroom day.

Control of learning tasks. The results for teacher control of learning activities have differed from those for control of behavior in four samples, ranging from first grade pupils in Follow Through to intermediate grade pupils of above-average socioeconomic status (SES) (Soar and Soar 1979). A result that emerged in each of those samples was that an intermediate amount of teacher control of learning activity was associated with greatest achievement gain. That is, if all the teachers in a sample were ranked from those who controlled learning tasks least to those who controlled most, those who controlled least would have less-than-average achievement gain; as one moved from classroom to classroom through increasing amounts of teacher control, learning would increase. But this would only be true for part of the progression. At some point, greater amounts of control would begin to lead to decreased gain rather than to increased gain. The relation is not a straight line, but rather a curve in the form of an inverted "U," in which the peak of the curve, representing most learning, falls somewhere near the middle of the range of teacher control. A colleague suggested the aphorism "in all things moderation;" but the saying should be modified as "for control of learning tasks, moderation."

Other differentiations. Another kind of evidence supports the concept of intermediate control of learning tasks as functional for most learning. There are findings that if a teacher behaves in a way that establishes close control, he or she may moderate that effect by means of another behavior permitting greater freedom. That is, the effect of one behavior may be moderated by the context of another behavior. These behaviors may occur at the same time or during separate activities at different times. For two controlling activities, for both achievement and motivation, the pattern of the teacher expressing one behavior frequently and the other rarely led to greatest gain. One behavior provides control; the other, freedom (Soar and Soar 1975).

Still another kind of evidence comes from measures that are assembled by factor analysis, a procedure that identifies patterns of behavior that tend to occur together. An example of this sort of measure is "seatwork with freedom," in which pupils are assigned work to do at their seats (high control), but having completed it are free to choose from other activities, to take part in independent activity, or to meet spontaneously (Soar and Soar 1975).

A final, potentially useful distinction between process measures that did not relate differently separates two kinds of higher-order questioning by teachers (Soar and Soar 1980). In one which we called "Guess or Hypothesize," the teacher asks pupils to go beyond the information given but without evaluation. For instance, "What do you suppose will happen next?" In the other form of questioning, which we called "Guided Discovery Backed Up by Facts," the teacher ". . . encourages pupils to go beyond 'the facts given' but prominent in the factor are items which reflect testing and evaluating, or backing up the ideas with facts" (p. 33).

One of the more consistent findings in the larger body of process-outcome research is that if teachers ask more higher-order questions, pupils learn less, even on high-cognitive-level outcome measures (Medley 1977). The distinction between kinds of higher-order questioning, which we have referred to informally as "loose and sloppy" *vs.* "hard-nosed," may help to explain this surprising finding. If much teacher questioning is loose and sloppy, in effect communicating that one answer is as good as any other, it would not be surprising if pupils did less well on tests for which some answers are scored as better than others.

Time on Task

Extensive evidence relates time on task to pupil achievement (Denham and Lieberman 1980). It seems to us that time on task is an example of teacher control of learning tasks, which, if true, would lead us to expect that its relationship to learning would also be nonlinear and that an amount less than the maximum would be optimal. Indeed, Carroll (1963), from whose formulation the current work stemmed, suggested that learning was a function of (a) time required for learning and (b) time spent on learning. His formulation seems to imply that more time than necessary could be spent, and several studies have found this to be true. Brophy and Evertson (1974) reported such findings. The Stallings-Kaskowitz (1974) study is often cited in support of increasing pupil time on task to increase learning. But Rim and Coller (1979) have reanalyzed those data, permitting curves to be fitted, and have found that the greatest time on task was associated with less learning than was an intermediate amount. The Far West Lab study (Fisher and others 1978), which focused on time on task, concluded that greater time on task was associated with greater learning. Analyses by this group usually examined straight-line relationships and contrasted the results of high and low time on task. However, some data in the study (p. 7-21) permitted the reader to examine the possibility of nonlinearity. These data showed gain in reading for three amounts of time on task as plotted against three levels of academic feedback to the pupil about the adequacy of his or her performance; if an intermediate amount of time on task were optimal, that could be seen. It was only for the lowest level of academic feedback that the greatest amount of time on task resulted in greatest learning; otherwise, the intermediate amount of time on task was best, and overall, it was slightly better. The authors commented that academic feedback was the measure most strongly related to achievement. One way to interpret this finding is to say that if the teaching is sufficiently ineffective, greater amounts of time on task may compensate. But given reasonably effective teaching, an intermediate amount of time on task is associated with the greatest learning.

Discussion

All of the differentiations of classroom process made here appear to be ones that teachers could make easily, once aware of the concepts. Such differentiations may be seen in classrooms without formal observation. We suspect that the distinction between control of behavior and control of learning tasks was not recognized in either the "open" classrooms or the contingency-management classrooms (those employing the principles of conditioning and programmed learning materials) in the Follow Through classrooms in which we collected data (Soar 1973). Our data suggested that neither of these programs distinguished between the two kinds of control; both kinds of freedom were extended to pupils in the open classrooms and learning was sometimes hampered by disorder; both kinds of control were exercised in the contingency-management classrooms, with learning both facilitated by the close control of behavior and hindered in some respects by the close control of learning activities. We wonder whether some of the problems associated with progressive education may also have followed from the lack of this distinction.

Expression of Affect

The affective domain is another aspect of classroom process within which differentiation of commonly used concepts sharpens relationships and may improve teaching. Affect has been studied extensively, reflecting the strong commitment held by educators and society to a supportive classroom climate. More recently, work distinguishing praise and reward from positive affect has extended our understanding.

Positive vs. negative affect. A single dimension for emotional climate is often used as a descriptor for expression of affect. It is frequently represented by a global rating scale ranging from something like cold to warm. But if expressions of positive and negative affect are measured by an observation system that counts occurrences, the two kinds of affect have only a low correlation—.40 or lower, and negative, of course. This implies that one ought to find teachers expressing various combinations of positive and negative affect, and so one does. As the usual concept of emotional climate implies, there are teachers who express positive affect generously and rarely if ever scold or criticize. Their classrooms may even seem cloyingly sweet. There are also teachers who scold, criticize, and demean pupils, rarely if ever having a good word for them. But there are teachers who express both kinds of affect freely; one always knows how such teachers feel. And there are teachers who rarely express either kind of affect, often creating well-organized, task-oriented classrooms in which activities flow and affect seems almost irrelevant.

The latter two kinds of teachers create measurement and conceptual problems. On the traditional emotional climate rating scale, where would we put the labile teacher who expresses both kinds of affect? Presumably in the middle of the scale, to represent that one extreme is balanced by the other. We would also place at the middle the teacher who expresses little of either kind of affect to represent that neither kind of affect occurs frequently. But they are very different kinds of teachers, and research suggests that they have quite different effects on pupils.

How, then, do these two aspects of emotional climate relate to pupil learning? As we would expect, negative affect tends to be associated with decreased learning (Medley 1977). But results for positive affect are more mixed, with about equal numbers of negative and positive relations with pupil achievement in Medley's review. This led one of our graduate students to do a meta-analysis (Wilkinson 1980), which in effect averaged the correlations from all the studies that measured positive affect in that review. The overall correlation between positive affect and achievement gain was .07. So positive affect may be like chicken soup—it may not help, but it's not likely to hurt.

How can this be, when one of the stronger beliefs of teachers and teacher educators is in the importance of positive affect for pupil learning? One possibility may be that we are all misled by thinking of emotional climate as a single dimension: If negative affect is bad then positive affect must be good, if the two kinds of affect are opposite ends of the same dimension. Another possibility may be illustrated by the finding (Soar and Soar 1974) that in a sample of traditional fifth grade classrooms, positive affect occurred most often when there was considerable pupil activity but little evidence of task focus—warm, friendly places, but not ones where much learning occurred. Perhaps in some classrooms, a positive emotional climate becomes an end in itself, displacing learning. But it is important, as we will indicate shortly, to emphasize that this relationship applies only to achievement as it is usually measured by standardized tests.

Positive affect vs. praise. In addition to the distinction between positive and negative affect, there is a growing body of evidence that we must also distinguish praise from positive affect in general. Medley's review indicated that praise was often positively related with learning, in contrast with positive affect in general, which was unrelated. On the other hand, positive affect was often related positively with self-concept and attitude toward school. The Stallings-Kaskowitz (1974) study cited in that review reported that positive affect was related either zero or negatively with achievement, depending on the measure, but it was related positively with the Ravens Progressive Matrices (1956, 1962), a measure of complex problem solving. In contrast with positive affect, praise was related positively to math and reading but negatively to the Ravens and an observational measure of pupil independence. In general, positive affect is unrelated to achievement gain but positively related to problem solving and noncognitive outcomes, whereas praise is positively related to achievement but zero or negatively to the Ravens and the noncognitive outcomes. So praise and positive affect appear to have different effects on pupils.

Brophy (1981) summarized much of the work on praise and has concluded that teachers often do not use it contingently. He suggested procedures by which teachers might make praise more effective.

The dubious consequences of praise. If the results for positive affect are surprising, those for praise are even more so. But there is a growing body of research to support these results, raising a serious question about the value of praise. An illustrative study is reported by Row (1974), in which observation identified differences in pupil behavior in classrooms that were high or low in "explicit verbal reward." In high-reward classrooms, pupils more often made responses that ended on a rising tone, implying "is this what you want?" and more often attempted to get the teacher's attention. In low-reward classrooms, pupils proposed more different explanations (science was the topic of study) and more often shared ideas with each other. Rowe (1974) suggested that reward appeared to make classroom interaction a game in which the objective for students is to gain praise from the teacher and to make the teacher, rather than logic and evidence, the authority.

As a way of following up this interpretation, Rowe brought 10 students to a laboratory, one at a time, from two contrasting classrooms. One of the classrooms was high in reward and wait time—the time a teacher waits for a pupil response—and the other was low in reward and wait time. Each pupil was shown a piece of laboratory equipment and asked to explain how it worked. Whatever the pupils suggested was disconfirmed by the teacher, the issue being whether the pupil would respond at least three times to point to the evidence. From the high-reward classroom, three of 10 pupils met this criterion, but from the low-reward classroom, seven of 10 did, suggesting greater persistence, problem solving and self-confidence.

Praise: informing vs. controlling. A larger body of research confirms and extends this interpretation. Deci and Porac (1978), in *The Hidden Costs of Reward,* indicated that reward has two elements: one that tends to exercise control; another that conveys information about one's competence. Deci and others (1982) summarized this well:

> . . . the experience of choice seems to be a necessary condition for the maintenance or enhancement of intrinsic motivation. Events that pressure people toward specified outcomes, thereby denying them the experience of choice, have repeatedly been shown to undermine intrinsic motivation . . . . In contrast, events that provide people with meaningful feedback in the context of choice have been shown to enhance intrinsic motivation . . . ." (p. 852)

The major point of Deci and Porac's article was that holding teachers accountable for pupil achievement appears to increase controlling behavior with probable negative consequences for pupil's intrinsic motivation.

If these interpretations of reward are applied to praise in classroom interaction, they suggest that when praise is used to control, to limit, or to eliminate choice by pupils, it will likely decrease intrinsic motivation; but if it is used to convey positive feedback about student competence in the context of choice, it is likely to increase intrinsic motivation.

The effects of reward on motivation. How teacher control is exercised, whether it relies on extrinsic incentives supplied by the teacher or intrinsic incentives encouraged in the pupil, is an issue raised by the work on praise. Further clarification is available from research dealing with effects of reward on performance and motivation. Notz (1975) summarized a body of work that indicated that where intrinsic motivation is present, applying an extrinsic incentive does not increase motivation but rather decreases motivation. Notz's results came from both the laboratory and real, adult life. As an example from real life, students who received low draft numbers (determined by a random procedure), making staying in college necessary to avoid the draft (an extrinsic incentive), had lower expectations for personal gain from the college experience than had students who received higher numbers.

McGraw (1978) summarized other work from both laboratory and classroom showing that some kinds of performance are increased by reward while other kinds are decreased. Among the performances that are decreased by reward are discrimination learning, insight, concept attainment, creative production, and incidental learning. In all of these, rewarded groups took longer to learn and/or made more errors than did the nonrewarded groups. As examples, fifth grade Israeli children performed less well at proposing titles for a literary paragraph when promised a trip to Tel Aviv than without that promise. When kindergarten children associated words with pictures, the group given a tangible reward (candy) made twice as many errors as those told "good" for right answers and "no" for wrong answers. Several studies found that adults learned complex concepts more rapidly under nonreward than reward conditions. Similar results were found for complex problem solving and the "unusual uses" creativity problem. Finally, for incidental learning, adults in several studies acquired more incidental information under nonreward than reward conditions, even when the incidental information was presented in a way that tends to distract attention from the assigned task. McGraw suggested that incidental learning is critical in that it may underlie and contribute to complex problem solving, insight, and creative production. It seems that vocabulary learning, which in our work has often profited from a less structured teaching style, may be an example of incidental learning in that it was not regularly taught.

In contrast, the kinds of performance that are facilitated by reward include motor performances, simple clerical tasks (lever pressing and letter cancelling), and rote learning. The frequent use of simple tasks such as these in the laboratory has probably contributed to the widespread belief in the effectiveness of reward for increasing performance.

In contrasting tasks facilitated with those hindered by reward, McGraw concluded that performances that are hindered have two characteristics. First, they tend to be attractive rather than aversive (people would do them without reward); and second, they are heuristic rather than algorithmic (the solution depends on developing strategies rather than applying strategies already known). Regarding attractive tasks, McGraw wrote that they ". . . appear to be tests of intelligence; and subjects, at least those in the student population, are generally motivated to do well regardless of whether they are rewarded" (p. 41). With regard to unattractive tasks, he commented, "All subjects know equally well how to perform the behavior and are equally capable of emitting it at a high rate. Only the reward subjects are motivated to do so, however; hence, the facilitating effect of reward" (p. 41).

McGraw commented in summary, "An implication that can be drawn from this is that reward's detrimental effects are potentially as widespread as its benefits. If that is so, psychology is certainly late in announcing this fact to the parents, teachers, and businessmen who would surely like to know it" (p. 57).

Discussion. It seems that these various threads relate to two contradictory views teachers often hold about praise—one being that it is a valued behavior, the other that contingency-management teaching is viewed with uneasiness because of the extreme control it enables teachers to exercise, control that is often established primarily by the contingent use of praise. These areas of research suggest that praise may be useful to teachers in facilitating performance of what McGraw referred to as "aversive tasks"—tasks, such as memorizing the multiplication table, that would not be carried out without some sort of reward. A considerable portion of the learning for which education is responsible is of this sort. Controlling praise, in Deci's terminology, may be appropriate in bringing about learning that might not occur otherwise, at least in the early stages. But for the attainment of more complex objectives and for increasing intrinsic motivation, controlling praise may be a liability.

A comment by Jencks and Peck (1976) may serve as a summary statement:

> If teachers supply immediate reinforcement, they must pay the cost of having students learn to rely on rewards that are external to the problem situation itself. This cost may be worth incurring if the teacher is merely attempting to get children to efficiently commit facts to memory. However, the price may be too high when students are learning new concepts or if they are engaged in problem-solving or pattern-searching. (p. 33)

Although much of the work cited by Deci and McGraw came from the laboratory rather than the classroom, the results helped to complete the larger picture by weaving together threads that give and reinforce meaning. Emotional climate in general and praise and positive affect in particular have often given rise to conflicting findings, and this work on the nature of reward and the nature of tasks in relation to intrinsic motivation helps to clarify the results.

Pupil Characteristics

This is the second group of context variables that clarifies relationships between classroom behaviors and pupil outcomes.

Socioeconomic Status

Socioeconomic status (SES) is probably the most studied among the variables in this group and is of interest in its own right. But it has a potential effect that is also important. Most of the large-scale research in the past decade has been federally sponsored and directed toward learning how to teach low-SES pupils better. Recommendations based on this major body of work really apply only to low-SES pupils, but this limitation is often lost. This makes the work on SES as a context variable particularly important because it identifies differences in effective teaching styles for different SES pupils and sharpens awareness of the limitations of the recent work.

Affect. A number of studies report complementary findings with respect to expression of affect as it affects achievement of pupils who differ in SES. Soar and Soar (1975) and Soar (1976) (a report of analysis of selected data from Coker's West Georgia College study) reported a moderate, negative relationship between teacher negative affect and learning for low-SES pupils. This correlation weakened as SES increased, becoming essentially zero for high-SES pupils. Although this result is initially surprising, it may reflect that the high-SES pupil is more likely to have support at home to compensate for unhappy classroom experiences, while the low-SES pupil more likely succeeds or not on classroom experience alone. The earlier of these studies also indicated that low-SES pupils are more likely to meet criticism than are high-SES pupils. Thus, those most likely to be harmed by criticism are most likely to receive it. We wonder about the extent to which these influences may account for low-SES pupils progressively falling behind in achievement.

Another finding from the same study may be related: A strong positive correlation existed between SES and change during the school year for motivation and internality of control (the expectation that one's efforts will make a difference). During the following summer, there was no correlation between SES and these variables, suggesting that being in school created the relationship. Again, the long-term implications are compelling.

Brophy and Evertson (1974) found a positive correlation between criticism and achievement for high-SES pupils but not for low. They commented that their classrooms were generally warm and supportive and that the occasional criticism that appeared to promote learning tended to be criticism of work that was not up to the pupils' ability. Solomon and Kendall (1976) reported a parallel finding—that degree of warmth in the classroom (broadly defined) was positively correlated with achievement for low-SES pupils but not for high.

These studies seemed to agree that negative affect is dysfunctional for low-SES pupils but may be functional for high-SES pupils. Conversely, positive affect may be functional for low-SES pupils but may not be for high. Again, for these findings, achievement is the only outcome considered.

Structure. Brophy and Evertson (1974) suggested that a central problem for the teacher of low-SES pupils is likely to be motivation: Pupils come to school apathetic and alienated from learning, so that the teacher's task is to support them with patience and encouragement. In contrast, high-SES pupils are more likely to come already motivated to learn, perhaps even overly competitive, so that "critical demandingness" is sometimes appropriate.

Beyond this, Brophy and Evertson suggested that a major role for the teacher of high-SES pupils is to provide challenge and variety, since those pupils are likely to learn basic skills with little difficulty; whereas the teacher of low-SES pupils must provide learning tasks that permit small-step learning with a high degree of redundancy, assuring students' continued success. Both these researchers and Soar (1976) indicated that higher amounts of structure of classroom activities are appropriate for low-SES pupils but that high-SES pupils can use greater freedom constructively. In a related finding, Soar and Soar (1975) found that pupils high in motivation achieved better than did those low in motivation in a setting with moderate freedom (seatwork with freedom).

The studies reported earlier, which indicated that reward hampers some kinds of performances (McGraw 1978), were with three exceptions completely consistent in suggesting that attractive, heuristic tasks were performed less well with reward. In reviewing inconsistent results, McGraw commented that the only common thread he could find was that these results came from studies that, in contrast to others, had used lower-class children as subjects. He suggested that those children probably had experienced less success with intellectual tasks of the sort posed, making the task so unattractive that they would engage in it only under conditions of reward.

Time on task. We earlier reported evidence that, for pupils in general, time on task could be too great or too little for greatest learning to occur. We implied that the optimum amount of time might be reached sooner for some pupils than for others. Guthrie and others (1976), in a study for the International Reading Association, collected data from a national sample of 931 reading groups and their teachers and reported results for high and low time on task and for pupils who differed in SES. For several reading and vocabulary measures, instructional time was significantly related to achievement for low-SES pupils, but ". . . this benefit did not occur for children in middle and high socioeconomic levels" (p. 24). For still another outcome, ". . . smaller gains in reading comprehension were made under conditions of maximum time than under conditions of minimum time for middle and high SES children" (p. 25). Because of the sample size and the care with which the sample was drawn, the results of this study warrant more serious consideration than most.

Discussion. If we attempt to summarize these findings for SES as a pupil characteristic that alters the relationship between a classroom process measure and a learning outcome, and if we are willing to tolerate a degree of looseness in order to generalize more readily, it seems that the organizing principles of affect and structure into which the results for differentiation of process measures were grouped become useful again. The results for affect indicated that avoidance of a negative climate is important for low-SES pupils, but that mild criticism of inadequate performance may be functional for high-SES pupils. For structure, the generalization appears to be that greater amounts are functional for low-SES pupils than for high. Greater structure appears in the form of simpler tasks with higher redundancy, a high success rate and increased time on task. The lower structure for high-SES pupils appears in the form of greater variety and challenge, a lower success rate, and less time on particular learning tasks. There is also the suggestion that reward may structure (controlling praise) or inform in a more complex performance. As a consequence, either may be appropriate, depending on both pupil and task.

Ability or IQ

Other studies have examined pupil ability or IQ as a characteristic that might alter process-outcome relations. These studies are reported next, since SES and ability have considerable overlap. Clark (1982) summarized the results of a number of aptitude-treatment interaction studies in which high- and low-ability students were compared in learning tasks characterized as having high or low information processing requirements. He used the terms *high* and *low load*, but his definitions have much in common with the term *structure* as we have used it. Low load provided structure or procedure; high load required the learner to provide the structure. The typical finding from these studies was that low-ability pupils learned more in the low-load (high-structure) conditions, and high-ability pupils learned more in the high-load (low-structure) conditions. These results seem to parallel those showing that low-SES students profit from high structure and high-SES students from less structure.

Corno (1979) studied the learning of pupils differing in IQ in classrooms differing in structure, finding that bright pupils learned more under low structure while less bright students learned more under high structure. Corno commented, "Too much teacher structuring may . . . be an unproductive use of time in a bright class" (p. 401).

Leinhardt and Pallay (1982) reviewed evidence showing that retarded pupils who were near the cutting point for special class placement were likely to do better in the least restrictive environment than were pupils who were further away from the cutting point. That is, within that group, brighter pupils did better in the less structured setting than did less able students.

Clark's (1982) quotation of Snow seems an appropriate summary:

> Lower ability students seem often to profit most from lower load methods which remove the information processing burden from them by providing structure and direction. Higher ability students seem to achieve more with higher load methods which apparently allow them to exercise their skills. (p. 95)

With regard to all of these results for structure, it seems useful to recall the results cited for teacher control of learning activity. The latter results showed that for most outcomes an intermediate level of control or structure was associated with greatest learning. Results in this section indicate that changes in the amount of structure that is optimal occur in relation to student SES or ability. Perhaps the caution is relevant here, too, that structure may be too great or too little to be functional, and our data, at least, suggest that it is not unusual for classrooms to exceed those limits.

Personality Characteristics

Anxiety is one of the personality characteristics most often studied as it modifies relations with classroom process. Grimes and Allinsmith (1961) found that anxious third graders learned less well with unstructured teaching than with structured teaching, when unstructured teaching was defined as reading taught by the look-say method and structured teaching as instruction by phonics. Both Domino (1975) and Dowaliby and Schumer (1973) found anxious college students learned best in teacher-centered classes, but that low-anxious students learned best in student-centered classes. The studies agreed in finding that high structure was best for high-anxious students and low structure best for low-anxious students. A parallel may be seen with the findings for SES and ability, in which low SES or ability pupils learned best with high structure. Both sets of results suggest that the student who is less able to cope is better served in a classroom with less complexity.

Grade Level

Surprisingly little research asks whether teacher-management behavior should differ from grade level to grade level, considering that teacher education programs are broken up into components for different grade levels. What research there is offers little support for management behavior having different effects at different grade levels.

Flanders (1970) presented correlations for a number of measures from his system for several grade levels, and it is clear that indirectness related differently with achievement at second grade than at higher grades. Brophy and Evertson (1974) commented that many tests of indirectness at the primary grades fail to find a relationship with achievement, in contrast with studies at the higher grades, which did find a relationship.

In studies that have made statistical tests of differences in relation to gain across grade levels, Soar and Soar (1980) found few such differences between first and fifth grade, although differences in relationship as a function of other pupil characteristics were common. For 12 of 13 measures, teachers behaved differently across grade levels, but the relations with pupil outcome were not different. Soar (1976), in an analysis of Coker's West Georgia data for grades 3 through 8, found two differences for grade level: (1) that teachers' effective communication was related more strongly at the lower grade levels and (2) teachers' use of information about pupil differences was related more strongly at the higher grade levels. But again, differences in relationship due to other pupil characteristics were more frequent.

Pupil Coping Style

Spaulding and Spaulding (1982) reported an extensive series of studies covering two decades and thousands of children. The characterizations of pupil coping styles were developed initially from personality theory and psychological research, from which low-inference observation schedules were developed, analyzed, and revised empirically. The final version is based on a factor analysis of individual observation data from over 1,000 pupils, which validated the earlier developmental work. Studies relating each of the styles to achievement have been carried out, but perhaps most important to classroom teachers, different procedures (treatment schedules) that are effective for working with pupils of each coping style have been developed and validated.

Application of their work involves the teacher first in identifying the coping style employed by a given pupil and then using the recommended treatment schedule for that pupil. As the pupil shifts from one coping style to another, the recommended treatment changes.

Evidence shows that the treatments succeed in moving pupils toward responsible, independent, self-directed behavior, thus increasing achievement as well as making life easier for the teacher and attaining an objective in pupil behavior that has social importance. The importance of this work is hard to overstate. Rather than focusing on a procedure applied classroomwide as a means of making teacher control of behavior more effective, it applies procedures to individuals based on individual coping styles that move them toward prosocial, independent behavior.

In addition to research findings that support the effectiveness of the treatment schedules, the authors presented a rich set of practical suggestions that clearly emerged from extensive classroom experience. Beyond this, there are informal reports that teachers find this system sufficiently helpful that they continue to use it and voluntarily come to meetings on their own time to learn more about it.

Discussion

Pupil characteristics such as SES, ability or IQ, grade level, and probably anxiety are context variables that fit Dunkin and Biddle's definition in the sense that they are fixed aspects of the teaching situation to which the teacher must adjust. Of the context variables discussed in this section, probably only pupil coping style can be changed. Research findings indicate that pupils who differ in these respects do require different teaching styles for most effective learning. Pupils who are low-SES, low-ability or IQ, or high in anxiety learn more in classrooms low in negative affect and high in structure. Further, low-SES pupils who may be most harmed by negative affect are most likely to encounter it.

The obvious solution to these different needs is individualization, but considerable evidence suggests that the typical teacher has difficulty implementing such a strategy (Medley 1977; Johnson 1979). Work by Spaulding and Spaulding (1982) may have provided a means of implementing individualization. To the degree that pupils can be taught constructive, self-directed coping styles, individualization becomes easier, and the differences in teaching style that fit different pupils implemented.

Further, Spaulding and Spaulding provided hope that the pupil who initially needs high structure can be helped to cope better with lower structure and eventually with life in the real world.

Different Process for Different Outcomes

This section concerns whether or not the kind of outcome alters the nature of the classroom process—that is, do relations between classroom process and outcome change depending on the outcome? It seems useful to group these changing relationships into two classes: those related to low vs. high cognitive level outcomes, and those related to cognitive vs. noncognitive outcomes.

Low- vs. High-Cognitive-Level Outcomes

When achievement is used as an outcome measure, it is often used as a single entity. But a body of evidence suggests that the cognitive level of the measure makes a difference. In our discussion of the differentiation of process measures, we presented evidence that, if teacher control of learning tasks is distinguished from control of behavior, the relationship between control of learning tasks and achievement is often an inverted "U" rather than a straight line. Greatest achievement gain tended to occur for intermediate amounts of this kind of control. This conclusion was further qualified by a finding that the amount of control for which greatest learning occurred shifted with the cognitive level or complexity of the learning outcome. For simple, low-cognitive-level outcomes, greater teacher control was best; but for more complex learning, less control was best. If the lesson was a rote one of memorizing the multiplication table or a list of spelling words, a closely structured drill would be appropriate. However, if pupils were solving complex problems or engaged in creative production, a much lower degree of control would be appropriate. As a related but more extreme example, Soar and Soar (1972, 1974) found that when teacher control of learning tasks was greater than average, still greater amounts produced materially less high-cognitive-level learning but the same or slightly more low-cognitive-level learning.

The Stallings and Kaskowitz (1974) report cited earlier found that positive affect was related either zero or negatively with achievement gain depending on the measure, but was related positively with the Ravens, a measure of complex problem solving. In contrast, praise was positively related with achievement but negatively with the Ravens and an observational measure of pupil independence. Corno (1979) found that while classroom structure increased achievement, it decreased performance on the Ravens for low-ability students but made no difference for high-ability students. Soar and Soar (1980) found that pupil interest-attention (a measure related to time on task) was related positively with low cognitive level learning but negatively with high cognitive level learning. This negative relation of a time-on-task measure with high-level achievement is surprising, but it may occur because observers have trouble seeing time on task when pupils are doing complex problem solving or processing information. The pupils may be staring into space or looking out the window, and the observer cannot know what's going on in their minds. Another possible interpretation is that increased time for pupils to work in their workbooks, which is easily seen as on task, displaces time for activities that foster more complex gain.

Overall, the results suggest that it is important to recognize differences in the cognitive levels of the outcomes, since each relates differently to process.

Cognitive vs. Noncognitive Outcomes

Another set of outcome measures for which there appear to be differences in relationships to classroom process is that of cognitive vs. noncognitive outcomes (or achievement vs. nonachievement, or cognitive vs. affective). Stallings and Kaskowitz (1974) reported that praise was related to increased achievement but to decreased Ravens and decreased independence. Similarly, Rowe (1974) found that higher levels of praise (which usually relate positively with achievement) were associated with lower levels of pupil independence, persistence, and self-confidence. Soar and Soar (1974) found that when the teacher frequently chose the problem and directed the learning activity closely, for the total group of pupils achievement was unaffected. However, anxiety increased and self-concept decreased. To the extent that praise is used as a way of controlling, these three studies agree that higher degrees of teacher control are likely to be associated with undesirable changes in noncognitive outcomes.

Giaconia and Hedges (1982), in a meta-analysis of 153 studies of open classrooms, identified those that reported greatest achievement gain vs. those that reported greatest nonachievement gain. Gain in nonachievement outcomes was associated with (1) emphasizing the role of the child in learning, (2) using diagnostic evaluation, (3) using a variety of materials, and (4) individualizing instruction. Greatest gain in achievement occurred in the open classrooms where these same procedures were employed less frequently than average.

Enjoyment of the classroom is another noncognitive outcome that is often studied. In the review of nine ATI studies cited earlier, Clark (1982) found support for the generalization that students typically enjoy most the method they learn least from—true for both high- and low-ability students.

Discussion

It seems clear that the nature of the outcome helps to determine which teaching style is most effective. Structure again appears to be a useful organizing principle, with higher structure associated with achievement gain as usually measured and lower structure associated with gain in complex problem solving and noncognitive outcomes. Praise seems to have undesirable effects on both the complex cognitive outcomes and the noncognitive outcomes. Perhaps the only encouraging finding with respect to the complexity of these results is that the same sorts of classroom process seem to be associated with gain in both complex problem solving and valued noncognitive outcomes, while a more restrictive set of processes seems associated with gain in achievement.

If we attempt to integrate the findings for different cognitive levels of achievement with those for complex problem solving and the noncognitive outcomes, again at the risk of going beyond the data, it appears that the most structure will be best for low-cognitive-level tasks such as rote memory, but that as the cognitive level of the achievement outcome increases, the degree of structure that is best decreases, becoming still less for complex problem solving and the noncognitive outcomes.

Application of these findings would require that the teacher change the degree of control of learning activities, depending on the outcome sought, admittedly a difficult task. But all these objectives are valued, and to teach at only one level of control appears to risk sacrificing some of them.

Summary and Implications

It is clear that consideration of context variables will lead to different recommendations for best teaching practice than if context is not considered. However, this theme recurs: that the nature of the pupil and the nature of the outcome determine which classroom process is best.

Briefly, 10 conclusions emerge:

1. Teacher control of behavior should be close, at least for attaining achievement objectives.
2. Teacher control of learning activities should vary from closer control for low-cognitive-level achievement to less control for high-cognitive-level achievement, complex problem solving, and noncognitive outcomes.
3. The relationship between control of learning tasks and achievement outcomes is not always linear; often, greatest gain occurs at an intermediate level of control: More is not necessarily better.
4. Positive affect is not related with achievement, but is with problem solving and noncognitive outcomes.
5. Praise is related positively with achievement (at least for low-SES pupils), but negatively with complex problem solving and noncognitive outcomes.
6. Reward increases performance of simple tasks but hinders performance of complex tasks.
7. Negative affect relates negatively with achievement for low-SES pupils; zero for high-SES pupils; but positively for high-SES pupils for criticism of work not up to standard.
8. For low-SES, low-ability, or high-anxious pupils, higher task structure is best; for high-SES, high-ability, or low-anxious pupils, less structure is best.
9. Higher structure is best for low-cognitive-level outcomes; lower structure is best for high-cognitive-level and noncognitive outcomes.
10. Time on task is another measure that is not always linear. The highest amounts sometimes decrease learning, especially for high-SES pupils and high-cognitive-level objectives.

These results make a compelling case for the consideration of context variables in teaching practice. No single style of teaching is best for all pupils and all objectives; the research points to ways in which teaching style should change. In particular, Spaulding and Spaulding offered specific help for teachers to work differently with different pupils.

Although this may seem an imposing or even impossible task, simple answers to education's complex problems will ignore the needs of many pupils who attend the nation's schools. Research suggests that we can do better.

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The Context of Teaching and Learning: School Effects and Teacher Effects

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It is my purpose to discuss the implications of research on effective schools and classrooms for programs of teacher training. My references to research will focus on studies of schools and classrooms in which nearly all students demonstrated at least minimum mastery on standardized achievement tests of mathematics and reading. At issue are questions of whether there are important pedagogical lessons to be learned from the descriptions and analyses of effective schools and classrooms, and whether those lessons have implications for the design of programs of teacher training. The discussion that follows is an attempt to explicate important elements of teacher training that ought to reflect lessons learned from research. More specifically, I will focus on three contextual aspects of what I regard as essential knowledge for beginning educators. Those contextual aspects are intellectual, psychometric, and organizational.

Teachers' decisions regarding instructional strategy derive from intellectual premises as to the origin of achievement. Achievement here refers to pupil acquisition of basic school skills as measured by standardized achievement tests. Since the publication of the Equal Educational Opportunity Survey (EEOS) in 1966, conventional social science wisdom has insisted that how well children do in school depends primarily on the nature of the family from which they come. The EEOS concluded that low-income and minority children suffer from environmental disabilities of such severity as to render them barely educable. Depressed achievement for low-income and minority students was thus presumed to derive from nonschool influences such as family background. This "familial effects" interpretation of the origin of achievement permeated programs of teacher training, leading them to teach that the relationship between pupil performance and pupil social class is causal. Middle-class children are presumed to bring to school linguistic, cultural, and social advantages that prepare them to learn in the ways that most schools prefer to teach. Lower-class and minority children are presumed to bring to school linguistic, cultural, and social disadvantages that impair cognitive capacity and ill prepare them to learn in the ways that most schools prefer to teach.

Such intellectual conclusions tend to depress educators' expectations of the academic ability of low-income and minority students. Research on expectations (Good 1981) firmly establishes that students for whom teachers have low expectations receive less academic work, less rigorous work, and are judged against a lower academic standard. Such teacher behaviors have the effect of creating classroom conditions under which low-income and minority students are least likely to demonstrate their capacity for satisfactory academic performance. Instructional strategies focused on low-income and minority children tend to be compensatory and often separate from the regular pattern of instruction, as in "pull-out" programs. Gains in pupil achievement associated with these compensatory strategies have been spotty at best. If familial effect continues as the pervasive intellectual premise as to the origin of achievement, we will be compelled to accept the present, depressing interaction between pupil performance and pupil family background.

Since the early 1970s, the literature of educational research has increasingly reported an interpretation of the interaction between pupil performance and family background that is at intellectual odds with the familial effect interpretation. Educational researchers such as Brookover and Lezotte (1979) and Edmonds (1983) have confirmed family background as a powerful correlate of pupil performance but have rejected family background as the cause of the correlation. Instead, they have concluded that *school response to family background* is the cause of depressed achievement for low-income and minority students. Studies by Brookover, Lezotte, Edmonds, and others described school behaviors and policies that cause depressed achievement for low-income and minority students. When schools place low-income students in the least rigorous classes in math and then lower curricular requirements for such classes, the schools effectively discourage minority participation in advanced classes such as calculus and physics. Such an interpretation of the origin of achievement is supported by these researchers' reports of schools in which the distribution of achievement is relatively independent of the social and racial character of the school's student population. Thus, these "school effects" researchers assume that basic achievement derives primarily from school influences.

In this context, two matters of intellectual import for the substantive content of preservice programs of teacher training arise.

Prospective teachers ought to be taught that there are now alternative interpretations of the origin of achievement. Further, they ought to understand that accepting one or the other of those interpretations has profound implications for a teacher's choice of instructional strategies. Intellectual acceptance of school effect leads to the conclusion that depressed achievement for any significant subset of the pupil population derives from school disability rather than familial disadvantage. Thus, instructional strategies focused on low-income and minority students would seek to alter the school's behavior. Specifically, note Rosenshine's (1982) attention to "teacher directed whole group instruction" as the preferred instructional strategy for increasing the proportion of a pupil population seen to profit from a school's program of instruction.

Rosenshine and Brophy (1982) and Good (1981) illustrated effective-classrooms research that complements effective-schools research. These teacher-effects researchers, like their school-effects counterparts, focused on classroom influences as the most important correlates of achievement. Their analyses dwelt upon the distribution of recitation, variability in the quality of teacher response to pupil recitation, variability in the time teachers wait for pupils to respond to questions and similar, observable teacher behaviors as measures of teacher expectations of academic performance for students of varied races and social classes. Teachers trained in the pedagogical import of such research would be better prepared to evaluate the instructional efficacy of their professional behaviors.

The intellectual import of school-effects research also holds significant implications for a teacher's sense of personal efficacy. Accepting the conclusions of familial effects research imposed substantial limits on the teacher's perceived opportunity to advance the educational interests of all students. For example, teachers may be rendered instructionally impotent in the face of the severe disadvantages that describe the nonschool environment of many low-income students—and this is particularly so when such students make up a large proportion of the school's population. To the extent that we train future teachers in familial effects analysis of the origin of achievement, we prepare them to despair when assigned to schools in which students are low income and minority.

Alternatively, teachers trained in a school effects analysis of the origin of achievement fix professional attention on those within-school staff behaviors about which teachers can do something, no matter the social or racial character of the pupil population. The explicit implication is that teachers do make a difference, and that it is a matter of some import that they choose effective instructional strategies and otherwise prudently spend their valuable time.

I do not mean to suggest that all teacher trainers must alter their intellectual posture as to the origin of achievement. However, I strongly suggest that these intellectual and social science issues are now fully joined, and that our students ought to be aware of competing interpretations of the dynamics of teaching and learning.

The October 1979 issue of *Educational Leadership* offered a practitioner-oriented, summary introduction to school-effects and teacher-effects research. The issue is a marvelous teaching device for those of us who want to introduce our students to these fields of inquiry. The December 1982 issue of that journal is another exemplary resource, focusing on the uses to which school-effects and teacher-effects research has been put in recent years. Having substantial bibliographies, both issues not only introduce the research and its uses but point to more technical papers in support of the summary discussions.

I want now to turn to essential knowledge in psychometrics—testing and measurement—for beginning educators. This discussion is grounded in the premise that the principal challenges for public schooling are two:

We must increase the instructional effectiveness of schools for low-income children if we are to resolve the crisis of public confidence in the efficacy of education, especially in urban settings. Public willingness to continue to invest a significant portion of the public treasure in public schools depends on the public believing that schools can and do appropriately educate those children presumed to be most disadvantaged. Public schools cannot long endure unless increasing proportions of such children are seen to acquire at least the minimum school skills prerequisite to satisfactory progress through the progressive levels of education.

Second, we must strive to reverse the perception that excellence in education is in decline, and that even those children who do well in school are not doing as well as they might or ought.

Resolution of these issues is intimately associated with prevailing practice in the testing and measurement of pupil progress. Most schools now assess pupil achievement by administering commercially prepared, norm-referenced, standardized achievement tests. The results of such tests are typically expressed as means or averages for entire schools or entire grades.

Norm-referenced, standardized achievement testing constitutes a formidable obstacle to resolution of the issues associated with greater achievement for low-income students. First, the tests measure students in relation to each other and therefore do not produce results that establish confidently whether or not individual minimum academic mastery has occurred. Norm-referenced tests are better measures of groups than of individuals. Second, mean or average aggregate school scores obscure whether and to what extent all students are progressing as they ought or might. If middle-class students in a school score sufficiently highly on a norm-referenced test, the resultant mean or average might appear deceptively high, even though the school's lower-class students uniformly fail to demonstrate adequate progress. The public would, therefore, lack a proper basis for judging whether or not the schools are doing what they should.

There is a readily available psychometric solution to these problems of testing and measurement of which prospective teachers ought to be aware. The best testing in this regard is curriculum-based, criterion-referenced, standardized measures of pupil progress. Criterion-referenced tests are grounded in an agreement as to the individual level of performance that constitutes minimum mastery.

The resulting scores thus have at least two psychometric advantages over normative measures: Students may be characterized as having passed or failed the test independent of the performance of their peers. Most importantly for purposes of this discussion, the proportion of pupils demonstrating mastery may thus be discerned, establishing whether and to what extent satisfactory progress extends to all of the social classes or races in a school. Teachers thus measure themselves and their school by noting over time the proportion of pupils demonstrating at least minimum mastery. Such an approach to testing and measurement is especially important for low-income students in that parents are given a relatively unambiguous basis for judging the progress of their children.

To the extent that educational equity is valued, prospective teachers ought to be sensitive to the equity implications of alternative techniques in testing and measurement. Finally, it must be noted that most school-effects and teacher-effects researchers explicitly focus on the extent to which school and classroom effectiveness extend to the full range of the pupil population. Schools cannot be judged effective if a significant portion of the pupil population fails to demonstrate mastery. Thus, any school attempting to exploit this research is compelled to psychometric practices that have certain of the properties associated with criterion-referenced testing. The principal methodological message to be conveyed to our students is the need for disaggregating the distribution of achievement. The interaction between achievement and social class can only be sorted out when test results permit an account of the proportion of pupil social class subsets seen to demonstrate mastery. A typical disaggregated analysis of the distribution of achievement takes the following form: First, school officials establish a minimum level of pupil performance required for mastery on the test being administered. The standard for mastery must be uniform and applicable to all students in the grade or school to be tested. Second, school officials must establish a uniform measure of high and low social class. For reasons of its statistical power of prediction, I use "mother's education" as the preferred measure of pupil social class, but many school officials find pupil eligibility for free and reduced lunch a less rigorous but satisfactory basis for assigning students to high or low social class. Many other measures have been used to make class distinctions.

After the test is given and individual mastery or failure established, achievement and social class data are analyzed to determine proportionate mastery for the social class subsets. School effectiveness is first a function of the proportion of the total population demonstrating minimum mastery. Second, school effectiveness is a function of the extent to which equal proportions of the social class subsets demonstrate minimum mastery. Uniformly high levels of mastery are not a measure of school effectiveness because middle-class children as a group will still outperform lower-class children as a group.

The final contextual issue to be discussed is the organizational context. One of the interesting issues in educational research is the identification of those teacher characteristics most consistently associated with teacher effectiveness. The nature of the school in which the teacher works clearly emerges as among the most powerful predictors of teacher performance. In sum, the school effect is more powerful than the teacher effect. This does not mean that individual teacher behavior is not a critical determinant of the quality of teaching and learning. It merely means that the school as a total environment has the capacity to depress or elevate individual teachers' capacity for effective or ineffective teaching.

The contextual implications of such a conclusion for teacher trainers seems straightforward. Prospective teachers must not be taught to believe that, if sufficiently rugged as individualists, they may close their classroom door and thereafter sustain the classroom environment requisite to teacher effectiveness. Effective-schools research describes the school as a fragile, volatile, interdependent entity in which the quality of each teacher's work is partly a function of the quality of all teachers' work. Such a characterization has at least two important organizational implications for programs of teacher training. First, the dynamics of teaching and learning should be taught as partly sociological in nature. (The traditional perspective in this regard has been psychological and individualized.) Both school-effects and teacher-effects research attend to the power of group dynamics and their effect on individual teachers and students. Thus, I make no implication that the discipline of psychology should cease to inform our programs of teacher training but that the discipline of sociology should be elevated in the extent to which it contributes to our perspective on pedagogy.

The second important organizational point is to emphasize teachers' dependence on collegiality when working toward school improvement. Singly, teachers lack the power to influence the larger school environment on which they depend. A critical mass of the teacher corps must make common cause if patterns of communication, interaction, and instruction are to be altered. I refer here to issues such as public-address interruptions, uniform approaches to tardiness, pull-out vs. whole-group instruction, and the other disparate elements of teaching and learning.

The school-effects and teacher-effects research of the last 10 years has produced at least two dramatic outcomes with important implications for colleges of education. First, the complementary and independent conclusions of Brookover, Lezotte, Edmonds, Fredericksen (1975) and Rutter (1979), etc., bring us close to social science certitude in the identification of within-school variables as the principal determinants of pupils' acquisition of basic school skills. Perhaps the more dramatic outcome has been the relative rapidity with which this research has come to influence educational practice. *Educational Leadership* (December 1982) described a few of the programs of school improvement based on this research. (A larger and more substantial analysis of the uses of the research may be found in V. II "The Extent of Adoption of Effective Schools Programs", Miles, M. et al., Huron Institute, Cambridge, Mass., 1983).

These descriptive analyses of school-improvement efforts based on school-effects and teacher-effects research permit our students to analyze the contribution of this research to professional discourse on teaching and learning.

I applaud the advancing dialogue on the interaction between research and practice and its implications for the American experiment in mass education. I eagerly look forward to further advances as increasing numbers of teacher trainers analyze the implications of these intellectual, psychometric, and organizational issues.

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Applications of Low-Inference Observation In Teacher Education

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In 1959, after 11 years of classroom teaching (in grades 3 through 8), I left the classroom and began a series of observational studies. As a classroom teacher, I had experimented with a variety of instructional, management, and control techniques and had found some success. However, my goals were never fully realized. Many of my students were responsive and acquired the skills and knowledge I had hoped for, but far more were much less successful; many were unable to keep up with grade-level standards. I had been individualizing instruction, believing that different students required different treatment, but my teaching was not informed by reliable measures of classroom teacher and pupil behaviors.

In my first study of classroom processes (Spaulding 1962), I developed a low-inference category system based on an earlier instrument, *Interaction Sample: Teacher*, devised by Richard Alpert and Margaret Pintler (Sears 1963) at the Laboratory of Human Development at Stanford University. Both the Alpert-Pintler instrument and mine focused on the teacher's use of reward and punishment in controlling the class. In creating the revised instrument, *Transaction Sample: Classroom* (Simon and Boyer, 1970; Spaulding 1965), I expanded the earlier version to include categories of instruction and listening, measures of the out-of-seat behaviors of pupils, transactions with other adults, publicity of communications, and measures of grouping practices. Data for individual pupils were not recorded. The focus of the instrument was on the teacher and the types of transactions engaged in, without regard to specific students.

The instrument was difficult to learn to use. Reliability training took several weeks and the coding process was extremely time consuming. Data were gathered by audiotape recording and direct observation. Tape analysis averaged eight hours for every hour of classroom recording. The primary goal of the study, however, was to test specific hypotheses; and no future use of the instrument was anticipated.

The study investigated teacher-pupil transactions in 21 classrooms in nine elementary schools in an upper-middle-class school district in California. When the specific categories of teacher interactions with pupils were correlated with measures of student self-concept, creativity, and achievement, no firm conclusions could be drawn. Of the 306 partial correlations computed, approximately 16 could be expected to reach a .05 level of significance on the basis of chance alone. Twenty-two significant partial correlations were found—12 in the direction predicted and 10 contrary to prediction (Spaulding 1962, p. 150). In subsequent analysis (Spaulding 1965), the data were clustered by factor (Q) analysis, identifying 17 components of teacher-pupil transactions. These components appear in Table 1.

It should be noted that almost as many components were obtained as there were teachers. Thus, these 17 components tended to identify specific teachers. The sample consisted of volunteers from grades 4 and 6 in a community where the average achievement of students was in the top 10 percent on national norms. The results obtained were useful, primarily as a source of hypotheses to be tested in subsequent experimental studies with better controls.

When teacher component scores were correlated with student outcome measures a number of significant relationships were found, as shown in Table 2.

These correlational findings suggested several hypotheses. The teachers in this study appeared to have a strong influence on the self-concepts of students. The self-concepts of the pupils were significantly higher in those classes where the teachers were "observant and small group facilitative, emphasizing appropriate task procedures and social relations through semi-automomous, semi-private small group process." In such classes, students were also significantly better able to differentiate between their academic and social strengths and weaknesses. Teachers who demonstrate teaching behaviors resembling this component may be expected to foster self-esteem in their students and enable them to identify and attend to their strengths and weaknesses. Another teacher pattern that appeared to facilitate pupil self-awareness was identified as "acceptant, controlling through standards, with appeal to convention as the source of authority, and avoiding negative evaluation."

In contrast to these two patterns, which appeared to foster self-esteem and self-awareness, several teacher components correlated negatively with self-concept. Teachers who were "dominating through use of shame, ridicule, and threat," or who used "formal group instruction with control through shame, ridicule, or admonition," or who displayed "unresponsive transactions with grim domination regarding rules (girls), skill or knowledge (boys), and paying attention (boys and girls)," or who demonstrated "cold,

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Table 1

Components of Teacher-Pupil Transaction

1. Observant and small-group facilitative, emphasizing task procedures and social relations through semiautonomous, semiprivate small groups.
2. Dominating through use of shame, ridicule, and threat.
3. Firm, dominating control with emphasis on paying attention, proper planning, and the use of appropriate procedures and resources.
4. Good-natured, personalized control with concern for sources of error, character, self-control, and proper social relations.
5. Calm, acceptant transactions in general with private, individualized instruction and a concern for divergency, attention to task, and the use of task-appropriate procedures and resources.
6. Businesslike lecture method with insistence upon attention to task and conformity to rules of procedure.
7. Supportive, receptive, responsive regarding pupil ideas and concerns.
8. Self-centered and judgmental transactions emphasizing acceptable skill, knowledge, and planning.
9. Warm, open transactions with boys, avoiding transactions with girls.
10. Formal group instruction with control through shame, ridicule, or admonition.
11. Observant-controlling, emphasizing attention to task and encouraging pupils' use of own abilities.
12. Acceptant, supportive, evaluative, with an appeal to group authority and responsibility.
13. Highly verbal and good-humored transactions with individuals or the class as a whole and an avoidance of small-group process.
14. Unresponsive transactions with grim domination regarding rules (girls), skill or knowledge (boys), and paying attention (boys and girls).
15. Acceptant, controlling through enforcing standards (with appeal to convention as the source of authority), and avoiding negative evaluation.
16. Cold, impersonal, public instruction emphasizing knowledge and skill and the use of shame or ridicule as a means of control.
17. Humorless transactions with control through threat and an appeal to outside authority in instruction.

impersonal, public instruction emphasizing knowledge and skill and the use of shame and ridicule as a means of control" were found to have students with significantly lower self-concepts. Teachers displaying these patterns also had students who were significantly less able to identify their strengths and weaknesses. Students of these teachers tended to see themselves as all bad.

In the area of academic achievement, significant correlations were found in the case of reading. Teachers who were "dominating through use of shame, ridicule, and threat" were found to have students with significantly lower scores on standardized tests of reading achievement. In contrast, teachers who demonstrated a "businesslike lecture method with insistence upon attention to task and conformity to rules of procedure" had students who performed significantly higher on tests of reading achievement.

Results for creativity indicated that cognitive flexibility and originality were associated with teachers who were "good natured" and used "personalized control with concern for sources of error, character, self-control, and proper social relations."

Taken together these findings suggested the importance of orderly, businesslike procedures within a supportive, acceptant climate. What kind of businesslike structure was

Table 2

Correlations of 17 Components of Teacher-Pupil Transactions With 8 Pupil Outcome Measures

	Pupil Outcome Measures							
Component	SC Mean	SC SD	Read	Math	Flex	Prob Solv	Synth	Orig
1. Observant-facilitative	48*	−68***	18	−19	11	−14	−19	16
2. Dominating-threatening	−71***	49*	−49*	−10	−20	−07	02	−16
3. Firm-dominating	−40	19	−27	−24	02	−03	14	18
4. Good-natured, personal	−25	33	−29	−19	−55**	−28	−10	−53*
5. Calm-acceptant	39	−34	04	−38	−11	−24	−20	−01
6. Businesslike-orderly	41	−13	44*	39	15	37	09	10
7. Receptive-responsive	16	−17	−05	−23	−10	−36	−10	−01
8. Self-centered with concern for knowledge	−18	19	−05	07	21	20	−02	11
9. Warm, open with boys	−16	16	−37	−38	−34	−41	−22	−30
10. Formal group instruction using shame and ridicule	−46*	61**	−42	−08	−49*	−06	05	−53*
11. Observant-controlling	32	−20	04	−20	−25	−14	−12	−16
12. Acceptant-supportive	09	−03	15	08	04	19	24	−12
13. Good-humored, verbose	−07	44*	10	30	−21	12	26	−09
14. Grim domination	−63**	43*	−34	−08	−20	06	11	−13
15. Acceptant-controlling, without negative evaluation	37	−48*	01	−29	19	−33	−26	35
16. Cold, impersonal, emphasizing knowledge	−52*	42	−21	04	−04	20	09	−11
17. Humorless, threatening	−37	22	−03	11	06	30	06	−10

Note: Decimal points have been omitted.
* $p = .05$ (two-tailed test)
** $p = .01$ (two-tailed test)
*** $p = .001$ (two-tailed test)

not clear, however. Nor was it possible to generalize to schools in middle-class or working-class communities. Initial observations in these California classrooms suggested that the amount of structure and the kinds of limits set had different effects on different kinds of students.

Pilot studies of individual pupils in classrooms in Urbana, Illinois (Spaulding 1963), indicated that teachers must structure curricula differently for different types of children. The creative intellectual, or creatively gifted student appears most highly motivated and constructively occupied in settings that establish clear limits but permit a wide range of choice for self-direction. The creative or inventive thinker appears not so much to want to become less involved with the classroom activity but to be permitted to enter into each activity with greater autonomy and responsibility:

> The "conforming achiever" seems most at ease and most productive when the lines of expectation are closely drawn and the instructions clearly given. With too much latitude responses tend to become regressive and defensive. Ego concerns appear to take precedence when lines of acceptable action are ambiguous, tending to push out his efforts at assimilation or accommodation of cognitive material. Attention appears to get focused upon external parameters related to defensive coping strategies rather than internal processes of scanning for thought structures appropriate to the cognitive task at hand. (p. 156)

These initial case studies in Urbana led to a strategy that has guided the past 20 years of research. It seemed important to identify specific types of pupils by observation in the classroom to permit analysis of teacher behavior by type of pupil. When a reliable and valid instrument focused on pupils was completed and a revised, more efficient teacher-observation instrument developed, the two instruments could be combined to create a matrix of paired teacher-pupil transactions. Such an approach would permit the development of specific recommendations that teachers might use experimentally to promote learning in individual cases. Rather than search for one approach appropriate for all students, the strategy would concentrate on identifying specific classroom procedures appropriate for types of pupils (as defined by their classroom coping behaviors).

The Development of a Student Classroom-Behavior Observation Instrument

Searching the literature for instruments comprehensive enough for use in the normal classroom, I found a series of studies of normal child development conducted by Lois Barclay Murphy (1956). The methods used by Murphy and her associates were primarily clinical. They generally involved a single child observed in a prepared environment. Children were also observed in group play and game situations. Finally, children were observed in the normal range of activities experienced in nursery school. The types of data gathered by the researchers appeared relevant to regular classrooms as well as to the settings used in the study.

One of the Murphy associates, Eugene Lerner, developed a "continuum of adaptive ego-rhythms," embracing 12 categories of children's adaptive styles. Lerner's "ego-patterns" sought to reflect the "more or less unified totality of self-feelings or self-ideas (ego-values)" (p. 271) that children selectively mobilize in response to internal somatic processes, external objects and events, and the acts of other persons.

Lerner called the child's selective mobilization "coping." The concept emerged from Murphy's work to describe the ways in which children meet the challenges of their everyday lives. Coping styles varied from child to child, but all children were found to use defense mechanisms as part of coping. Coping, or adaptational, styles could be ascertained "only by careful scrutiny of all aspects of the functioning of each child as these interact with one another and with the environment" (p. 155).

The child or older youth in the public school brings with him or her the coping style that he or she has found useful in the past. The school environment is a special setting, with its own climate, demands, stimulation, stress, and growth-supporting factors. The problem of diagnosis in the classroom relates closely to the coping style the individual pupil brings to school. The pupil's adaptation results from the interaction of his or her coping efforts and the response of the school personnel and classroom peers to those efforts.

With Lerner's "continuum of adaptive ego-rhythms" as a point of departure, an instrument to observe coping behaviors in school settings was developed. The Coping Analysis Schedule for Educational Settings (CASES). This instrument has been adapted to focus on the coping behaviors commonly observed in classrooms and other school environments. Schools typically establish both social and academic norms for behavior. Constraints and sanctions are created to strengthen desirable behaviors and weaken undesirable behaviors. Within this special environment, pupils may use a limited range of adaptive behaviors. The CASES instrument is designed to characterize the specific adaptive behaviors employed by pupils as they seek to obtain their objectives.

The current form of CASES evolved over 10 years of application in public schools in Illinois, New York, and North Carolina. Scoring modifications have continued to the present. The first data sets came from a regular elementary school in Urbana, Illinois. There, teachers enrolled at the University of Illinois were asked to observe three pupils each over a period of 12 weeks using the CASES instrument. The first form of the instrument included many of the terms used by Lerner. The case studies were continued for 10 to 12 weeks, as the pupils under study experienced the normal pressures, requirements, deadlines, social interactions, and examinations that children commonly experience. No specific outcomes were hypothesized; instead, the data gathered were examined for relationships, patterns, idiosyncracies, and salient events that might explain the social and academic development of the observed students. These initial efforts developed problems of reliability. The observers were unfamiliar with ego theory and unable to achieve satisfactory levels of interobserver agreement. As a consequence, the Lerner terminology was modified to include operational definitions of the categories, and some of the categories were expanded or divided (or dropped) to make them more relevant to the classroom setting.

During this period of augmentation and transformation, the integrity of the Lerner category system was retained as much as possible. The researchers resisted the temptation to add categories to accommodate the special circumstances of ages, levels, and curricula. When the ego terminology was dropped in favor of operational definitions in order to achieve reliability of data recording, a determined effort was made to reflect faithfully the theoretical bases of Lerner's original 12 categories. This decision to retain the theoretical foundations of the system proved providential, since later factor analytic data reductions resulted in interpretable factors rooted in psychological theory. In fact, the most useful scoring keys used the factor structure found in normal school populations and permitted the CASES data to be compared with clinical data derived from other sources. The resulting CASES scores are easily interpreted by counselors, teachers, psychologists, and others trained in social learning and ego psychology. The final form of the CASES instrument (in its brief form) appears in Table 3.

Relationships of CASES Scores to Other Classroom Variables

From 1962 through 1965, students in my education courses at the University of Illinois and at Hofstra University in Hempstead, New York, conducted case studies of elementary school children experiencing the daily events of their regular school programs. Time samples were made of normal children over approximately 12 weeks of school attendance each semester. These time samples (normally at 10-second intervals for 10 to 15 minutes each visit) were made during the full range of classroom activities and subject matters. Approximately 135 case studies were completed at the University of Illinois; about 1,800 at Hofstra University. Each case study included the plotting of selected CASES-category percentage scores as a function of each of the 18 variables shown in Table 4.

These exploratory studies of relationships between CASES categories and specific classroom variables (as

Table 3

The Coping Analysis Schedule for Educational Settings (CASES) (Brief Form)

	Category Description (Abbreviated)
1	Aggressive, hurtful, destructive behavior
2	Negative, attention-getting behavior
3a	Controlling others in a prosocial manner
3b	Controlling others in a self-serving manner
4	Resisting, delaying, defensive checking
5a	Appropriate self-directed, independent activity
5b	Inappropriate self-directed, independent activity
6a	Paying close attention in accordance with teacher expectations
6b	Paying close attention to events unrelated to the task at hand
7a	Integrative sharing and helping in accordance with expectations
7b	Integrative sharing and helping in conflict with expectations
8a	Integrative social transactions in accordance with expectations
8b	Integrative social transactions in conflict with expectations
9a	Integrative seeking and receiving help in line with expectations
9b	Integrative seeking and receiving in conflict with expectations
10	Following directions and teacher expectations submissively
11	Observing passively and checking on noises and movements
12	Responding to internal stimuli
13	Physical withdrawal, avoidance of involvement, and escape

shown in Table 4) revealed a number of persistent correlations but varied according to the types of pupils under observation. For example, the amount of structure provided (as measured by the clarity of limits, the clarity of goals, and the degree of choice permitted) correlated positively with appropriate, self-directed, independent activity (category 5a) in one type of student and negatively in another. These findings led to an effort to identify types of pupils by their characteristic coping behaviors or patterns of behaviors.

Development of CASES Coping Styles

Six clusters of CASES categories were first identified by sorting the hundreds of case studies into groups that appeared to have common characteristics. Each of the groups was then examined to identify the characteristics uniting them. The result: the six CASES styles shown in Table 5.

These six "coping styles" were used for about 10 years until sufficient case-study data were gathered to use factor analysis to identify clusters of behavior in a more efficient and valid manner. An early effort focused on discovering the relationships between each of the variables in Table 4 and the six CASES styles. Values on each of the 18 classroom variables were correlated with CASES-style percentage scores. As a consequence of these investigations, five sets of "treatments" were identified that could be tested in experimental case studies for effectiveness in improving pupil's behavior. Table 6 presents the values to be set by teachers on each of the 18 variables (as defined in 1968).

Results of Experimental Studies Using the Five Treatment Schedules

From 1965 to 1970, a series of studies was completed as part of the Durham Education Improvement Program in Durham, North Carolina. The program was funded by the Ford Foundation as part of its efforts to support public school desegration in several states in the South. One phase of the program involved the creation of an experimental primary school in a low-income section of Durham where studies could easily be made of curricular innovations and experimental teaching procedures. In this laboratory

Table 4

Classroom Variables Correlated with CASES Category Percentage Scores

1. Clarity of limits
2. Clarity of goals
3. Narrowness of limits (degree of choice permitted)
4. Demands for academic achievement
5. Publicity of punishment
6. Publicity of positive reinforcement
7. Amount of punishment
8. Amount of positive reinforcement
9. Demands for social competence (in peer relations)
10. Presence of adult authority (now generally termed "proximity")
11. Degree of support and guidance available or given
12. Demands for physical competence (fine motor or gross motor)
13. Opportunity for manipulation of concrete materials
14. Demands for quiet
15. Demands for immobility (sitting still or staying in seat)
16. Demands for formal thought (in contrast to concrete operations)
17. Provision for concrete operations in curriculum design

Table 5

Six CASES Behavior Styles Identified by Content Analysis of Case Studies

Style	CASES Categories	Style Descriptors
A	1, 2, 3b, 4	Aggressive, annoying, bothering, dominating, controlling, resistant
B	4, 5b, 2	Passive aggressive, resistant, delaying, sullen, hostile, watchful, cautious
C	9b, 11, 12, 13	Dependent, passive, withdrawn, fearful, watchful, distractible, avoidant
D	7b, 8b, 9b, 11	Talkative, social, gregarious, peer dependent
E	5a, 7a, 10, 9a	Obedient, docile, submissive, compliant, dependable, studious, conforming
F	3a, 5a, 6, 7a, 8a	Independent, productive, responsible, assertive, integrative, thoughtful

school, the effects of the five treatment schedules were examined.

All pupils enrolled in the school were observed daily to track their coping styles using the CASES instrument. Teachers were then taught to structure their interactions with each of the students according to the treatment designed for each coping style. The teachers were also observed daily to determine the degree to which appropriate treatments were, in fact, performed.

The goals of the treatment schedules (as shown in Table 6) were to increase Style E (obedient, docile, submissive, compliant, dependable, studious, conforming) behaviors in teacher-directed settings and Style F (independent, productive, responsible, assertive, integrative, thoughtful)

Table 6

Treatment Schedules for Six Coping Styles (circa 1968)

	CASES Coping Style				
Variable	Style A	Style B	Style C	Style D	Style E
Clarity of limits set	high	high	high	high	med/low
Clarity of goals set	high	high	high	high	high
Degree of choice given	none	none	none	some	some
Academic demand made	low	low	average	average	high
Publicity of punishment	private or semiprivate	private	private or semiprivate	private or semiprivate	private
Publicity of reinforcement	semipublic	public	semipublic	semipublic	semipublic
Amount of punishment	contingent on crossing limit	minimal	contingent on crossing limits	minimal	minimal
Amount of reinforcement	contingent on desired acts	contingent on desired acts	contingent on desired acts	contingent on desired acts	minimal
Demand for social skills	low	low	averge	average	average
Presence of authority	high	high	high	low	low
Support and guidance given	high	high	average	average	low
Demand for physical	average	low	average	average	average
Use of concrete materials	high	high	average	average	average
Degree of peer choice	low	high	low	average	high
Demand for quiet	high	low	average	low	low
Demand for immobility	high	low	average	low	low
Demand for formal thought	low	low	average	average	high
Demand for concrete thought	high	high	average	average	average/low

Note: Style A = aggressive, resistant; Style B = withdrawn, dependent; Style C = distractible, social; Style D = adult dependent, compliant; Style E = independent, productive, self-directed. (These styles were redefined in 1974 as a result of factor-analytic studies of large samples of students in regular, public school classrooms.)

behaviors in seatwork (or non-teacher-directed) settings. As reported by Spaulding (1978b),

> Style E behaviors of EIP pupils were found to increase significantly in teacher-directed settings and gains in Style F were significant in non-teacher-directed settings, as hypothesized. Comparisons with control subjects were nonsignificant for Style E and significant for Style F. These results suggested that the experimental EIP program and the local public school programs (controls) were equally effective in promoting dependent, conforming, and submissive behavior in those settings in which teachers asked for attention, cooperation, and compliance. In contrast, the EIP program (using the five experimental treatments) resulted in a significantly greater amount of independent-productive, assertive, thoughtful, and integrative behavior in school settings where pupils were expected to work on school-appropriate tasks without direct supervision or instruction.

In a subsequent analysis (Spaulding and Papageorgiou 1972), the relationships between Style F behavior scores and academic achievement were examined. Significant correlations were found between Style F behavior in seatwork settings and achievement scores in word knowledge and word discrimination (as measured by the Metropolitan Achievement Test Battery). Nonsignificant results were obtained for total reading and arithmetic.

When a weighted total score (combining scores for all six CASES styles) was used, pupils with higher overall scores were found to have significantly higher word knowledge, word discrimination, and total reading scores. Relationships with arithmetic achievement were again found nonsignificant.

These findings were encouraging, but the teachers found the treatment schedules difficult to master. Observation of the teachers indicated that most could not keep the schedules in mind while teaching. Further work was needed to validate the specific treatments and to improve the procedures for teacher training.

When I moved to San Jose State University in 1970, an opportunity came to improve the CASES scoring procedures. The initial grouping of categories to produce styles required restructuring. Several CASES categories were used in more than one style, and case studies using the six styles revealed a need for better definition.

CASES Styles Identified by Factor Analysis

During the academic years 1972-73 and 1973-74, CASES data were gathered in 10 school districts in Alameda and Santa Clara Counties, California. Seven graduate students in education at San Jose State University were trained to use the CASES instrument. Training continued until the observers reached an average of 89.9% exact agreement while coding simultaneously in ongoing classes. Inter-rater agreement between pairs of coders ranged from 74.4% to 97.6%.

Public school pupils in kindergartens using the Hawaii English Program were the first group observed for the factor analytic study. This group consisted of a 50% sample of all children enrolled in kindergarten in six schools in six Santa Clara County school districts. The number of pupils observed was 149. The Hawaii English Program emphasizes self-managed learning, tutors, learning stations managed by pupils, individualized instruction, mastery learning, and continuous progress through programmed learning materials. A minimum of teacher-directed learning occurs in the program.

The second group of students in the sample consisted of 386 pupils in kindergarten through grade 2 in a single school using the Hawaii English Program. All CASES data were gathered while the pupils were in a large room where the learning stations were located. Two regular teachers supervised groups of 90 pupils at a time. The school was located in a middle-class community.

The third sample included all pupils in kindergarten through grade 3 in a low-income, working-class community. Data were gathered in all subject-matter areas during normal school routines. The number of pupils included in the sample was 222.

The fourth group of students in the norming sample consisted of 337 pupils enrolled in kindergarten through grade 6 in a single school in a low-income, working-class community. All subject areas and instructional modes were sampled.

The fifth and last group consisted of 64 middle school and high school students referred by their teachers for observation in a suburban, middle-class community in Alameda County, California. Behavior problems were common in this group. Teachers nominated students who were discipline problems as well as some with academic problems. None of these pupils, however, was considered eligible for special education.

The CASES data for 1,066 of the 1,158 students in the complete sample were scorable and became the data base for factor analysis. Students in kindergarten through grade 3 were overrepresented. The sample, however, appeared diverse enough to present the range of behavior patterns likely to be found in the public schools of Santa Clara and Alameda Counties, California. The middle and high school grades were poorly represented, and a different factor structure would likely result if a larger sample of middle and high school CASES data were included.

A Varimax factor analysis resulted in seven factors. One was bipolar and interpreted as two separate behavior styles—self-directed on-task behavior (5a) and teacher-imposed on-task behavior (10). The results of the analysis are shown in Table 7.

The first factor accounted for approximately 13.2% of the variance. It resembled the previously identified style A pattern. The third factor (accounting for 7% of the variance)

Table 7

Main Varimax Factors Extracted from 1,066 CASES Data Sets Gathered in Grades K-12 in Santa Clara and Alameda Counties

	Rotated Factor Loadings							
CASES No.	1 (A)	2 (F)	3 (B)	4 (G/H)	5 (C)	6 (E)	7 (D)	h^2
1	.33	.26	-.03	-.12	-.18	-.05	.25	.29
2	.64	.02	.36	.09	-.04	-.13	.01	.56
3a	.12	.57	-.08	-.04	.08	-.25	.00	.42
3b	.48	.24	.20	.02	-.09	-.05	.02	.34
4	.23	-.13	.50	.22	-.05	-.12	-.16	.41
5a	.02	-.24	-.20	-.84	-.01	-.11	-.09	.83
5b	.08	-.13	.63	-.11	.04	.02	.01	.43
6a	-.21	-.14	-.11	.29	-.17	-.63	-.11	.59
6b	-.09	.05	.04	.02	-.07	.07	.08	.67
7a	.26	.18	-.06	-.17	.19	-.61	-.04	.54
7b	.39	-.10	.44	.07	.18	-.10	.10	.41
8a	-.09	.81	-.09	.04	-.03	.14	-.13	.71
8b	-.03	.14	.74	.15	.03	.24	.06	.66
9a	.39	-.21	-.25	.11	.02	.43	-.26	.52
9b	.63	-.10	-.02	.09	.02	.14	-.05	.43
10	.24	-.26	-.01	.69	.07	-.11	.01	.62
11	.30	-.24	-.10	.25	.28	-.02	.49	.54
12	-.02	-.03	.16	.00	.71	-.07	.00	.54
13	-.05	.04	-.07	.04	.67	.05	-.02	.46
Factor Var	.132	.081	.070	.066	.063	.058	.055	

Note: Each CASES data set consisted of approximately 40 observations (at 10-second intervals) of each of 1,066 students. The letters identifying the eight CASES coping styles are shown in the column head. The underlined factor loadings indicate the CASES categories associated with each of the eight CASES styles. Factor 4 is bipolar and the two highest loadings (of opposite signs) identify two CASES styles—category 5a = style G; category 10 = style H.

was similar in content to the pattern earlier named style B. The fifth factor (with 6.3% of the variance) also resembled a previously named pattern, style C. For the most part, however, the factor structure relocated the 19 categories, and a number of unanticipated patterns emerged.

Table 8 shows the eight CASES coping styles and the content of each, based on factor analysis of 1,066 data sets from Santa Clara and Alameda Counties.

With the first factor extracted, the percentage of variance associated with each factor became fairly even (ranging from a low of 5.5% for factor 7 to 8.1% for factor 2). The relatively even distribution of factor variance indicated that the CASES instrument was effective in discriminating among significant differences in the classroom behavior of students. In addition the newly identified factors were found to be more easily interpreted to teachers and counselors than were the earlier CASES styles. When case studies were made, the current factor structure was found useful in diagnosing and prescribing treatment.

Current CASES-Style Structure

After several years of research using the factor structure given in Table 8 as the basis for style scores, a few modifications became desirable. The coping styles of the pupils were found to be strongly influenced by the amount of structure and direction provided by the classroom teacher. The coping styles that the pupils preferred were most likely to emerge when classroom activities were loosely structured and the teacher gave little or no direct instruction. The scoring sheet for CASES coping styles was modified to accommodate the changes expected in students when the amount of teacher direction varied. For example,

Table 8

Eight CASES Styles Identified Through Factor Analysis (circa 1974)

Style	CASES Categories	Style Descriptors
A	1, 2, 3b, 9b	Dominating, active-aggressive, annoying, bothering, controlling, manipulating
B	4, 5a, 7b, 8b	Resistant, passive-aggressive, delaying, peer-oriented, off-task
C	12, 13	Passive, withdrawn, avoidant, shy, dreamy
D	6b, 11	Peer dependent, distractible, off-task
E	6a, 7a	Attentive, adult-oriented, compliant
F	3a, 8a	Assertive, socially integrative, task-oriented
G	5a	Appropriately self-directed, task-oriented, independent, self-motivated, nonsocial
H	10, 9a	Conforming, passive, submissive to directions

Note: Category 9a was not found strongly associated with any one factor. From 1964 through 1982, it was scored as part of style E. It is now located as a part of style H as a result of case-study analysis.

category 6a (paying close attention) was a logical component of style E (attentive, adult-oriented, compliant) in teacher-directed settings. That category, however, was more closely associated with style G (self-motivated, on-task, nonsocial) during seatwork. In such situations, 6a represented the pondering that accompanied problem solving activities. Another change was made in the location of category 9a. In the factor structure (as shown in Table 7), category 9a was not clearly associated with any one factor. Although it seemed to fit logically with style E, it had an opposite sign in the factor structure. Category 9a was sometimes found, in case studies, as a component of style A behavior. In such cases, it may have been seen by the observer as manipulative behavior (3b). It also appeared, frequently, as a part of style H (other-directed, conforming).

The 1982 CASES scoring procedure was written with 9a (appropriate help-seeking, appropriate help-receiving) as a component of style H. The current assignments of the 19 CASES categories for obtaining scores for the eight CASES styles appear in Table 9.

Equal weights are used in scoring raw CASES frequencies. The resulting style scores are used to characterize the behavioral milieu of the class and identify the most promising procedures to use in the classroom in order to maximize the on-task behavior of the pupils as well as their self-control, self-management, and cooperation. The specific treatments recommended for each type of pupil (as classified by coping style) are based on the outcomes of experiments conducted in the Durham Education Improvement Program and at San Jose State University. Using the initial values for 18 classroom variables under teacher control (as shown in Table 6), experimental treatments were developed for seven of the eight styles identified through factor analysis.

Descriptions of the Eight CASES Coping Styles

On the basis of approximately 160 case studies conducted by graduate students at San Jose State University in various schools and classrooms the characteristics of the eight behavior patterns may be described. Not only are the coping styles meaningfully interpretable by the descriptors associated with the 19 categories of the CASES instrument, but individual pupils described on the basis of CASES low-inference data are easily recognized by their teachers. The eight CASES coping styles are characterized, in turn, in the following sections.

Style A Behavior. Style A students demonstrate little internal control and are likely to act out and create disturbances. They may become verbally or physically aggressive, and they frequently attempt to manipulate other students or the teacher to obtain what they want. They are willing to incur the disfavor of others in order to get attention. They cannot be relied upon to stay on task without close supervision and a high degree of teacher imposed structure (i.e., specific procedures and detailed tasks).

Descriptors and CASES codes that identify style A students are: aggressive, annoying, bothering (2), abusive and hurtful (1), destructive (1), dominating, controlling (3b), and manipulative (3b, 9b).

An example of a normal, second grade boy displaying style A behavior is given in the following quotation from a case study:

> The school file described him as a highly disruptive child who had difficulty in controlling his hostility and aggression toward others. He employed various kinds of attention-seeking techniques toward others to disrupt classroom activities. He was a bright boy who did not complete assigned tasks.
>
> This child annoyed other children by ripping or marking their papers, running around the room, and taking objects from other children's desks. He made loud noises in the classroom or yelled across the room to the teacher or others. He was involved in fights daily; he would fight to be first in line, first out the door, or first to use a piece of equipment—kickball, earphones, filmstrip projector, and so on. (Bartholomew 1977, p. 3)

Style B Behavior. Style B students resist authority and imposed structure. They prefer to do things in their own way and at their own pace. They are generally peer oriented and talkative. They cannot be relied upon to stay on task in social settings. However, they have strong drives to maintain control over their lives. If they have been well socialized during childhood, they will seek to be productive and exert power and control in prosocial ways. Confronted with arbitrary power, they may bridle. Given no confrontation with authority, they can work well alone on tasks set broadly, with the focus on products to be created in their own way.

If not properly socialized, style B students will delay productive involvement, preferring to socialize with peers. Such unsocialized, resistive pupils cannot make good use of freedom or choice. They will continue to delay and interact inappropriately with peers if goals, guidelines, and relevant tasks are not provided. Different treatments are required for the two types of style B students. Those who have strong drives to be productive and who have been well socialized by their parents can be readily persuaded to cooperate with the teacher (or other school authorities) by a suitable restructuring of the instructional program to make use of their concerns about achievement, power, and self-management.

Descriptors and CASES codes identifying these students are: inappropriately self-directed (5b), inappropriately socially active (7b, 8a), peer oriented and talkative (7b, 8b), resistant to authority (4), delaying, and nonconforming (4).

Examples of style B behavior follow. These are based on observations of normal pupils in regular, public school classrooms.

> "John" is an attractive and healthy 7-year-old in a K-1 class. He is an extremely bright, expressive, and imaginative boy, the kind of student who is often stifled and whose actions are often misinterpreted in a normal classroom . . . . He is sure of his abilities but is not sure that he is a worthy person. John has great potential for being a productive and responsible member of the class. (Stark 1975, p. 1)

> "Danny" is a fourth grader of exceptional ability who resists my requests and spends much of his time engaged in inappropriate activities. (Souza 1975, p. 1)

> "Paul" is very friendly, and would rather spend his time talking to his friends than doing his work. Today, Paul was defiant. He spent most of the time wandering around the room, engaging in conversation with others not in his group, and watching what everyone else was doing. If he did sit where he belonged, it was only for a few moments, and then he was working a puzzle, and not doing

Table 9

Scoring Key for Eight CASES Styles (1982)

Style	Data from TD[a] Settings	Data from NTD[b] Settings
A	1, 2, 3b, 9b	1, 2, 3b, 9b
B	4, 5b, 7b, 8b	4, 5b, 7b, 8b
C	12, 13	12, 13
D	6b, 11	6b, 11
E	6a, 7a	7a
F	3a, 8a	3a, 8a
G	5a	5a, 6a
H	10, 9a	10, 9a

[a] TD = teacher-directed
[b] NTD = non-teacher-directed (self-directed or program-directed)

> what he should have been doing. (Shelton 1975, pp. 1-2)

Style C Behavior. These students are fearful and avoid situations involving risks. They will withdraw if confronted with a social or academic threat. They will not initiate disturbances but they will participate as observers. They cannot be relied upon to remain on task without close support and a high degree of structure. If they become blocked during seatwork, they will await assistance rather than actively seek solutions. If they become involved in a disturbance with other students, they will withdraw rather than seek to resolve the problem through negotiation. They fear retribution and often find solace in their thoughts. Left to themselves, they tend to daydream and respond to internal stimuli.

Sometimes, pupils who might at other times be aggressive will use withdrawal as a strategy to avoid a threatening confrontation. When confronted by superior power or authority, they use withdrawal as a temporary tactic, avoiding a direct challenge to their power or control.

Descriptors and CASES codes that identify style C students are: responding to internal stimuli (12), physical withdrawal (13), and avoidance of involvement by moving about and watching from a distance (13). Here is an example of a style C pupil in a special education class:

> One of the most striking features of "William's" behavior is his slowness. He strongly prefers not to risk an error and often came to a firm halt for long periods of time, becoming quite immobilized. During these times he used compulsive behaviors, such as finger counting and crossing. These behaviors had the look of self-stimulation . . . . He is heavily focused on his inner world and that inner world is attentive to being fed. (Warfield 1982, pp. 1-2)

Other examples of style C students appear in regular classrooms. This example comes from a day-care center:

> Everyday, "Mary" walked slowly into the 4-year-old room with her head dropped and thumb in her mouth . . . . Mary walked slowly to her locker to put her coat or sweater away and then milled absently around the room, looking at her peers who were involved in activities. (Fikes 1971, p 5)

Another example is from a second grade class in a public school.

> "Forrest" arrived . . . as a new student this year. He was immediately noticeable because he never smiled, never raised his hand to comment and looked off to the side or down whenever anyone spoke to him . . . . Forrest was not only shy and uncomfortable but also unable to accomplish much in the way of work. Whenever he didn't understand directions he would cry. Tears came also when someone would try to correct an error no matter how gently. (Carruthers and Hustler 1972, p. 1)

Style D Behavior. Students who demonstrate style D behavior are easily distracted. They respond readily to noise and movement in the environment. They watch other students work and are easily led by more dominant students into participation in inappropriate activities. They frequently copy the work of others and are likely to wait for their peers to produce models for them to copy.

Style D students are concerned with peer approval. They willingly follow the lead of more skilled or powerful pupils in the class. They are less concerned with authority and approval from adults. These students often seek out satisfying activities by watching others in the room.

Descriptors and CASES codes identifing these students are: attending to distractions (6b) and checking on behaviors, noises, and movements of others (11). The following example of style D behavior is taken from a case study of a seventh grade boy (Nelson 1981).

> "John" was the last one to enter the room. He went to his desk, opened his workbook, and gazed around the room. He looked up at anyone or thing moving, at any foreign sound, and he was distracted by noises outside of the windows behind him. (p. 4)

Style E Behavior. Style E students are concerned with adult approval and show respect for authority. They want to know what the rules are and they want to do what is expected by those in positions of authority. They frequently become anxious if they are not clear about what is expected of them. They will respond to clear statements of goals and procedures. They prefer to have specifically defined assignments with little ambiguity regarding the steps to take to complete the tasks.

Style E pupils cannot operate for extended periods of time without teacher support and approval. They can be relied upon to follow instructions, but need frequent reassurance that they are, in fact, doing what is expected of them.

During teacher-directed instruction, style E students pay close attention. They follow the rules by raising their hands before speaking and they contribute appropriately when given the opportunity. Once instructions have been completed and seatwork assigned, they immediately begin to work on the assignments. They usually shift into style H when doing seatwork, although many are able to maintain self-management and task orientation with interest and will show style G behavior. They are more likely to demonstrate style G behavior when the seatwork is highly structured, with little choice involved. They work best when models are provided and support available. They frequently share their work with the teacher to obtain reassurance that they are proceeding in the manner expected by the teacher.

Behavioral descriptors and CASES codes that identify these students are: compliant (7a), dependable, attentive (6a), thoughtful (6a), conforming (6a, 7a). They can be depended upon not to cause disturbances and will not distract others from assigned tasks.

Style F Behavior. Pupils who prefer to work together and are able to stay on task display style F behavior. Style F students have internal controls and can stay on task in spite of temptations to get off task. Style F pupils also have problem-solving abilities and work out assigned problems without teacher assistance. They like to work closely with other style F students, sharing solutions and methods of completing the assignments.

These pupils can be relied upon to stay on task in the absence of supervision. Most also have considerable initiative and often seek novel ways of solving problems. They usually enjoy the opportunity to test their mettle, rising to challenges provided by the teacher. Style F students are frequently willing to participate as classroom aides; many enjoy tutoring younger pupils. They can be depended upon to follow through on assignments outside the classroom and are frequently eager to bring in additional materials and resources to enrich classroom studies. Style F students respond well to self-managed study plans involving choice. They enjoy taking on additional responsibilities that provide opportunities for problem solving, leadership, and self-directed learning.

The behavioral descriptors and CASES codes identifying style F students are: assertive (3a), socially integrative (3a, 8a), task oriented (8a).

Style F behavior is seldom observed in the public school classroom. If students are not permitted to talk, they cannot display these characteristics even if they possess them. Teachers often assume that any talk that takes place will disturb others and get the talkers off task. The assumption is understandable: Since talk by style A, B, and D pupils will most certainly be off task, teachers who do not distinguish style F students as fundamentally different in their motivations will expect them to be off task as well.

Style G Behavior Whereas style F students, given the chance, will work closely with a friend, style G pupils elect to work alone. They even remove themselves from others to increase their isolation and improve their concentration. Some style G pupils may lack the social skills to interact successfully with other students, but most do not. Their isolation is usually a matter of choice. They feel that they accomplish more and get their work done more quickly when they work alone.

Style G students respond well to self-managed study plans involving choice. These students have internal controls, clearly established academic standards, personal goals, and problem-solving skills commensurate with their levels of academic and cognitive development.

When teachers forbid talking in the classroom, it may become difficult to distinguish style G students from style F students. Only when opportunities to interact socially are provided will the preferences of students be noticeable.

Behavioral descriptors and CASES codes that identify style G students are: appropriately self-directed (5a), task oriented (5a, 6a), independent (5a, 6a), self-motivated (5a, 6a), and nonsocial. The 6a category emerges when seatwork and other non-teacher-directed activities are scheduled. It represents thoughtfulness and self-managed problem-solving.

Style H Behavior. Style H students submit to authority and are externally motivated to remain on task. When not supervised or directly instructed, they will demonstrate other preferred coping styles or behaviors. Their preferred styles cannot be determined in highly teacher-directed or highly supervised settings. When confronted, they submit to the direct authority of the teacher or other authority. In the absence of direct supervision, they may hesitate, demonstrating style B behavior. Others may begin to look around the room, distracted by noises and movements, thus displaying style D. Some will withdraw into themselves to satisfy their needs by self-reinforcement through self-touching and reverie, showing their preferred style C behavior. If the teacher is far removed, those students preferring styles A or B may begin to interact socially off task and bother one another or draw attention to themselves.

A classroom program that keeps students in style H by close supervision and tight controls will not encourage the development of internal controls. The threat of classroom disturbances and off-task behavior in the absence of supervision keeps most teachers from relaxing the structure and external controls common to the public school classroom.

If the preferred styles of the pupils are to be discovered, classrooms must be non-teacher-directed. When the CASES instrument is used to identify a student's preferred style, the observations must include school situations in which opportunities to socialize, talk, work on assignments, delay, move about the room, obtain assistance when needed, and so on are all present.

Generalizability of CASES-style Scores

To obtain information on the generalizability of CASES-styles scores, a two-way analysis of variance was made using CASES data gathered for 19 students (18 boys and one girl). Seven pupils were observed in early childhood settings (preschool through first grade), five in the middle grades (fourth through seventh), one in a high school journalism class (the girl in the sample), and six in special education classes.

The design used to estimate reliability of CASES-style profiles is shown in Table 10. The design is based on a two-way analysis of variance with fixed rows (CASES-style scores), random columns (pupils), and random visits to

Table 10

Expected Mean Squares for Two-Way ANOVA
(Eight coping styles, 19 pupils, 10 visits per pupil)

Sources of Variation	df	MS	Expected MS
Coping Styles (S)	S-1	$a = \sigma^2 + \sigma^2_{SV(P)} + 10\,\sigma^2_{SP}$	$+ 190\sum_{1}^{19} \frac{\alpha^2_S}{18}$
	P-1	$b = \sigma^2 +$	$+ 8\,\sigma^2_{V(P)} = 80\,\sigma^2 p$
Pupils (P)	(VP-1)-(P-1)	$c = \sigma^2 +$	$+ 8\,\sigma^2_{V(P)}$
Visits V(P)	(S-1)(P-1)	$d = \sigma^2 + \sigma^2_{SV(P)} = 10\,\sigma^2_{SP}$	
Interaction SxP	SP(V-1)	$f = \sigma^2 + \sigma^2_{SV(P)}$	
Interaction CxV(P)			
Total	(SPV)-1		

observe the same pupil. The purpose of this design was to provide empirical estimates of the amounts of variation in CASES scores from five identified sources. The five sources were: (1) variation in strength of the eight CASES-style scores among 19 students; (2) variation in CASES-style score totals among the 19 pupils observed; (3) variation due to visits to observe the same pupil; (4) variation due to differences in the style profiles among the 19 pupils; and (5) variation due to the interaction of visits with styles and any other source. The source of major interest is variation in CASES-style profiles over visits.

The results of the generalizability analysis of variance for eight styles, 19 pupils, and 10 visits are presented in Table 11. The estimates of component variance are shown in the right hand column of the table. As shown, variance associated with pupil profiles over eight styles was .366. Differences between pupils in relative strength of style-score totals were relatively small (.013). Variation among the eight CASES styles accounted for .047 of the variance. Variation due to visits and unknown sources was combined and accounted for .611.

Generalizability estimates were computed using the following formulas:

(a) reliability of pupil profile over eight styles, scored for one visit:

$$P_1 = \frac{\sigma^2 SP}{\sigma^2 SP = \sigma^2 SV(P) = \sigma^2} \text{ Estimate } r_1 = \frac{.366}{.366 + .611} = .375$$

(b) profile reliability based on *k* visits:

$$P_k = \frac{\sigma^2 SP}{\sigma^2 SP + \frac{\sigma^2 SV(P) + \sigma^2}{k}} \text{ Estimate } r_1 = \frac{.366}{.366 + .061} = .857$$

The results of these calculations of profile stability were a generalizability coefficient of .375 for one visit and a coefficient of .857 for 10 visits. These findings indicated that at least 10 visits should be made to observe a pupil before style scores are used to make judgments about the characteristic coping styles of pupils. In case studies using CASES, the practice used (and recommended) by the author is to observe for 10 days (or 10 visits) before deciding upon treatment.

Validity of CASES-Style Scores

The first argument for the validity of the scores obtained using the CASES instrument rests on the low-inference nature of the categories and the theoretical underpinnings of the system as a whole. Over the past 20 years, numerous studies have been made of normal and exceptional pupils in various school settings. In the majority of these studies, the style descriptors have matched the perceptions and descriptions of the students' teachers and counselors.

A second argument stems from the correlations found between CASES-style scores and context, process, and product variables. Two studies have investigated relationships between CASES-style scores and selected context, process, and product variables using scores for individual pupils within existing classrooms. The first study (Spaulding and Papageorgiou 1972) examined relationships between CASES style F scores, style G scores, and weighted overall coefficients (OC) and the academic achievement of 179 primary grade children in the Durham Education Improvement Program (EIP) as measured by the Metropolitan Achievement Test Battery. The second investigation (Mahen 1977) examined relationships between all eight CASES styles and overall scores and a number of context, process, and product variables using data gathered

Table 11

ANOVA Table for Eight Styles, 19 Pupils, and 10 Visits Per Pupil

Source of Variation	df	SS	MS		Variance Estimate
CASES Styles (S)	7	92.462	13.209	$a = \hat{\sigma}^2_S$	$(=) \frac{a-d}{190} = .047$
Pupils (P)	18	19.325	1.074	$b = \hat{\sigma}^2_P$	$(=) \frac{b-c}{80} = .013$
Visits V(P)	171	8.407	.049	$c = \hat{\sigma}^2_{V(P)}$	estimate not possible
Profiles (S x P)	126	538.276	4.272	$d = \hat{\sigma}^2_{SP}$	$(=) \frac{d-f}{10} = .366$
Interaction SxV(P)	1,368	731.470	.611	$f = \hat{\sigma}^2 + \hat{\sigma}^2_{SV(P)}$	$(=) \quad f = .611$
Total	1,519	1,389.940			

in six elementary school classes in Edmonton, Canada. The Mahen study included two first grades, two third grades, and two sixth grades. The correlations were computed separately for each grade.

The results of these two studies appear in Tables 12 and 13. In each table, only the significant correlations are given. Correlations found with CASES data gathered in teacher-directed settings are shown in Table 12. Results obtained using CASES data gathered in non-teacher-directed settings are given in Table 13.

Relationships with CASES-style Scores Based on Data Gathered in Teacher-directed Settings

Among students who were observed as style A (aggressive, dominating, bothering, and/or manipulative) during teacher-directed activities, significant relationships were found with the following variables:

a) difficulty in completing school work (greater),
b) interpersonal relations with peers (positive),
c) anxiety in class (lower).

Many more significant relationships were found in the case of style B students. Among pupils who were observed in teacher-directed settings as off task and delaying, resistant, and/or peer oriented, correlations were found with the following variables:

a) satisfaction with school (less),
b) friction with peers in school (less),
c) difficulty in completing school work (greater),
d) general attitude toward school (negative),
e) total attitude (positive in the class with higher intelligence, negative in another),
f) MAT reading scores (higher in the class with higher intelligence),
g) language-arts grades (lower in one class, higher in the class with higher intelligence),
h) behavior grades (lower),
i) anxiety in class (lower),
j) academic self-image (lower).

Among style C students (those observed to be withdrawn, shy, dreamy, or avoidant in teacher-directed settings), significant correlations with the following variables were reported:

a) difficulty in completing school work (greater),
b) general attitude toward school (negative),
c) instructional interaction (negative),
d) interpersonal relations with peers (positive),
e) MAT reading scores (lower),
f) language-arts grades (lower),
g) behavior grades (lower),
h) anxiety in class (lower).

Among students observed as peer dependent, distractible, and off task during teacher-directed activities (style D), significant correlations were found with the following variables:

a) satisfaction with school (less),
b) competitiveness with peers (greater),
c) cohesiveness (more cohesive),
d) interpersonal relations with peers (positive),
e) language-arts grades (higher),
f) behavior grades (lower).

Table 12

Correlations Between CASES Style Scores in Teacher-Directed Settings and Selected Process and Product Variables

		CASES Styles								
Variables	Class	A	B	C	D	E	F	G	H	OC
Satisfaction	2-1				-46*					
	1-3		-66**							
Friction	1-1						-43*			
	1-6		-43							40*
Competitiveness	1-3				49**					
	2-1								44*	
Difficulty	1-1		43*	61**				43*		
	1-6					40*				
	2-6	53*								
Cohesiveness	1-6				50*					
General Attitude	1-3		-75**	-39*		41*				54*
	1-6					45*	42*			
	2-6		-54*			65**				
Instr. Interaction	1-1			-43*						
Interpersonal Relations	2-1			44*	45*					-53*
	2-3						40*			
	2-6	46*								
Total Attitude	1-3		-49**							
	2-6		51*							
Total MAT Reading	1-1					64**			-70**	55*
	1-3			-53*						51*
	2-6		63**							
Language-Arts Grades	1-1					65**		53*	-67**	68**
	1-3		-52*	-55*						49*
	1-6					41*	56**	52**		40*
	2-6		47*		49*			51*		
Behavior Grades	2-1					48*				
	1-3		-54*	-46*	-38*					55**
	2-3		-46*	-57**		38*				48**
	1-6						45*	48*		
	2-6							50*	-49*	
Anxiety in Class	1-3	-39*	-59**	-47*			-48*		46*	45*
	1-6							44*		
Academic Self-Image	1-3		-56*							
	2-6							59**		
Process Questions	2-3							79**	-65*	
	2-6								-49*	

Note: Decimals are omitted. The second numeral in the class code indicates grade level. Class size ranged from 20 to 31 pupils.
*p = .05
**p = .01
The achievement data are post-test only.

Table 13

Correlations Between CASES Style Scores in Non-Teacher-Directed Settings and Selected Process and Product Variables

		CASES Styles								
Variables	Class	A	B	C	D	E	F	G	H	OC
Satisfaction	1-3					-41*				
Friction	1-3				38*		-38*			-41*
Competitiveness	2-1						47*			
Difficulty	1-3		38*		44*			-54**		-51**
	2-6					70**		-40*		
Cohesiveness	1-6				50*					
	2-6				-43*				-42*	40*
General Attitude	1-3		-47*	-48*				47*		47*
	2-6								49*	
Instr. Interaction	2-1		-65**							
	1-3	-41*								
	2-6				-44*				-41*	
Interpersonal Relations	1-1	43*								
	2-1			47*			-57**			
	2-3	-41*								
Total Attitude	2-1		-59**							
	1-3	-43*								
Total MAT Reading	1-1	-46*	-43*		-40*			57**		57**
	2-1							47*		
	2-3		57*							
	2-6				-49*					
	EIP								-25**	19*
MAT Word Discrimination	EIP								-23**	
MAT Word Knowledge	EIP							21**	-23**	
SAT Social Science	2-6			-48*						45*
Language-Arts Grades	1-1		-40*		-48*			57**		57**
	2-6				-48*					
Social Studies Grades	2-6			-48*					-49*	49*
Behavior Grades	2-1			-43*						
	1-3				-43*	-65**		68**	-45*	56**
	2-3							37*		
	2-6			-47*					-40*	56**
Anxiety in Class	1-3			-39*						
	2-6							41*	-48*	
Academic Self-Image	1-3			-62**				50**		50**
	2-6								-69**	45*
Process Questions	2-1					66**				
	2-3								57*	
Product Questions	2-1		49*							

Note: Decimals are omitted. The second numeral in the class code indicates grade level. Class size ranged from 20 to 31 pupils.
EIP = Durham Education Improvement Program sample (n = 179).
*p = .05
**p = .01
The achievement data are post-test only.

Relationships between CASES style E behavior (attentive, compliant, adult oriented) in teacher-directed settings were generally positive. Significant correlations with style E scores were found with the following variables:

a) difficulty in completing school work (greater),
b) attitude toward school in general (positive),
c) MAT reading scores (higher),
d) language-arts grades (higher),
e) behavior grades (higher).

Style F students (assertive, socially integrative, on task) were found to have significant correlations with the following variables:

a) friction with peers in school (less friction),
b) attitude toward school in general (positive),
c) interpersonal relations with peers (positive),
d) language-arts grades (higher),
e) behavior grades (higher),
f) anxiety in class (lower),

Among students showing style G (self-motivated, on task, nonsocial) behavior during teacher-directed activities, the following variables were found significantly related:

a) difficulty in completing school work (greater),
b) language-arts grades (higher),
c) behavior grades (higher),
d) anxiety in class (higher),
e) academic self-image (higher),
f) process questions (asked more).

The degree to which students were conforming, passive, and/or submissive to directions (style H) during teacher-directed activities was found to be significantly related to the variables shown below:

a) competitiveness with peers (greater),
b) MAT reading scores (lower),
c) language-arts grades (lower),
d) behavior grades (lower),
e) anxiety in class (higher),
f) process questions (asked more).

The weighted overall coefficient (OC) was designed to take into consideration all eight coping styles and measure overall competence in coping with social and academic expectations in the classroom. It was intended primarily as a predictor of academic achievement. The results found for the overall coefficient, based on data gathered in teacher-directed activities, validated OC as a predictor of achievement. The following correlations were found:

a) friction with peers in school (greater),
b) general attitude toward school (positive),
c) interpersonal relations with peers (poor),
d) MAT reading scores (higher),
e) language-arts grades (higher),
f) behavior grades (higher),
g) anxiety in class (higher).

The students with higher overall coefficients in these classes obtained higher grades and higher scores on achievement tests at the cost of higher anxiety in class and greater friction and poorer relations with peers. In spite of problems with peers, these pupils retained a positive attitude toward school.

Relationships with CASES Style Scores Based on Data Gathered in Non-teacher-directed Settings

Among students observed in style A (dominating, aggressive, bothering, and/or manipulative) during seatwork and other non-teacher-directed settings, the following correlations were reported:

a) instructional interaction (negative),
b) interpersonal relations with peers (positive in one class, negative in another),
c) total attitude (negative),
d) MAT reading scores (lower).

When students were observed to be resistant, delaying, peer oriented, and off task (style B) during non-teacher-directed activities, relationships with the following variables were found:

a) difficulty in completing school work (greater),
b) general attitude toward school (negative),
c) instructional interaction (negative),
d) total attitude (negative),
e) MAT reading scores (lower in one class, higher in another),
f) language-arts grades (lower),
g) product questions (asked more).

Among students observed as withdrawn, shy, dreamy, and/or avoidant (style C) during non-teacher-directed activities, significant correlations were found as follows:

a) general attitude (lower or poorer),
b) interpersonal relations with peers (positive),
c) Stanford Achievement Test social science scores (lower),
d) social studies grades (lower),
e) behavior grades (lower).

When students were observed to be off task, peer dependent, and distractible (style D) during seatwork and other non-teacher-directed activities, significant correlations with the following variables were found:

a) friction with peers in school (more),
b) difficulty in completing school work

(greater),
c) cohesiveness with peers (greater in one class, less in another),
d) instructional interaction (negative),
e) MAT reading scores (lower),
f) language-arts grades (lower),
g) behavior grades (lower).

When correlations were computed using scores for style E (attentive, compliant, adult oriented) students in non-teacher-directed settings, the following variables were found significantly related:

a) satisfaction with school (less),
b) difficulty in completing school work (greater),
c) behavior grades (lower),
d) process questions (asked more).

When correlations were made using scores for style F (assertive, socially integrative, on task) behaviors during seatwork, significant relationships were found with the following variables:

a) friction with peers in school (less),
b) competitiveness with peers (greater),
c) interpersonal relations with peers (negative).

Among students observed as style G (self-motivated, on task, nonsocial) during seatwork, correlations with the following variables were found:

a) difficulty in completing school work (less),
b) general attitude toward school (positive),
c) MAT reading scores (higher),
d) MAT word-knowledge scores (higher),
e) language-arts grades (higher),
f) behavior grades (higher),
g) anxiety in class (higher),
h) academic self-image (higher).

When correlations were computed for style H (conforming, passive, submissive) behaviors using data gathered in non-teacher-directed settings, the following variables were found significantly related:

a) cohesiveness with peers (less),
b) general attitude toward school (positive),
c) instructional interactions (negative),
d) MAT reading scores (lower),
e) MAT word-discrimination scores (lower),
f) MAT word-knowledge scores (lower),
g) social studies grades (lower),
h) behavior grades (lower),
i) anxiety in class (higher),
j) academic self-image (lower),
k) process questions (asked more).

Results of correlations with achievement and grades using the overall coefficient (OC), which measured the overall coping competency of the student in non-teacher-directed settings. Significant correlations were found with the following variables:

a) friction with peers in school (less),
b) difficulty in completing school work (less),
c) cohesiveness with peers (greater),
d) general attitude toward school (positive),
e) MAT reading scores (higher),
f) SAT social science scores (higher),
g) language-arts grades (higher),
h) social studies grades (higher),
i) behavior grades (higher),
j) academic self-image (higher).

Students with higher overall scores during seatwork achieved higher grades, higher scores on achievement tests, enjoyed less friction with peers, found school work less difficult, felt greater cohesiveness with peers, and felt positive about school.

These findings indicate that the eight styles are meaningfully correlated with relevant context, process, and product variables. They show that styles E and F are the most functional behavior patterns during teacher-directed activities and that style G is clearly the most functional in non-teacher-directed settings. These results also support the use of treatment plans that encourage students to display style E and F coping styles in teacher-directed settings and style G during non-teacher-directed activities.

Treatments for Changing Student Behaviors

When the number of CASES styles was increased to eight as a result of the factor analysis, the original five treatment schedules (Table 6) were revised to accommodate the newly identified factor structure. Seven treatments were worked out to strengthen styles E, F, and G in teacher-directed settings and style G and/or F in non-teacher-directed settings (Spaulding 1978a: Spaulding and Spaulding 1982). Experimental studies employing one or another of the seven treatments, or combined treatments when a student was found to display more than one coping style, were begun in 1975 and continue to the present. Table 14 summarizes 32 such studies.

The presenting problems (inappropriate coping styles) are indicated in the column marked "Baseline" in Table 14. For example, the first study (Bagar 1982) reported styles A, C, and H during baseline. During treatment, the boy in the study showed styles A and G. When the teacher returned to baseline conditions, the boy displayed styles A and H. When treatment was reinstated, the boy was observed in style G. The final column gives the observer reliability (whenever data were available).

The successes of the 32 studies constitute a measure of validity of the seven treatment schedules. Of the 18 studies of pupils demonstrating style A during baseline, none reported style A as present during reinstatement (a success rate of 100%). Of the 12 case studies of style B students, two

Table 14

Summary of Case Studies Using CASES-Based Behavior Control Treatments: Predominant CASES Styles Under Four Conditions

Study	Year	Age	Sex	Baseline	Treatment		Reversal	Reinstatement		Obs.
					TD	NTD		TD	NTD	Rel.
Bagar	1982	11	M	A/C/H	—	A/G	A/H	—	G	.84
Bahha	1975	7	M	B/G	H	—	A/B/H	G/H	—	NA
Bartholomew	1977	7	M	A/B/E	D/E/F	G	A/E/G	E	G	NA
Beeler	NA	6	M	A/B	—	E/F	A/B	—	E/F	NA
Brown*	1976	12	M	C	—	C/G	C/G	—	B/G	NA
Carlson	1979	6	M	A/E/H	—	A/H	A/H	E/H	—	NA
Ching	1975	5	M	A/F	—	G	A/G	B/C/H	—	.84
Coulter*	1981	8	M	H	A/H	—	A/B/H	E/H	—	.93
Erbes*	1980	9	M	A/C/E	E/H	—	C/H	E/H	—	.88
Hillman	1976	4	M	D	none	none	A	—	E/G	NA
Houston	1979	16	G	A/C/H	—	C/H	C/D	—	C/H	.87
Johnston	1979	4	M	C/D/E	—	E	A/E	—	E	NA
Marchesini	1975	7	M	A/B/H	A/H	—	A/G	G	—	NA
Messimer	1977	7	M	A/C/D	—	G	C/G	—	G	.85
Mintegui*	1981	15	M	A	—	A/E	A/D/G	—	D/G	.84
Nelson	1981	12	M	C/D	—	C	B/G	—	G	.94
O'Connell	1975	11	M	B	—	B	A/B	—	G	NA
Oiler	1980	15	G	C	—	F/G	B/G	—	F/G	.88
Pattee	1975	4	M	A/E/G	—	C/D/G	F	—	F	NA
Rivera	NA	4	M	E/G	—	E/F	—	—	E/F	NA
Roeding*	1976	11	M	B	—	G/E	B/G	—	G	NA
Schimmel	1975	10	M	C/E/G	—	E	—	—	—	NA
Shelton	1975	11	M	B	—	F/G	B	—	G	NA
Skehen	1975	6	M	A/E	—	G	A/G	—	E/G	NA
Souza	1975	9	M	B/E	—	G	A/H	—	E/G	NA
Stark	1975	6	M	A/B	—	E/F	A/B/E	—	E/F	NA
Swift	1975	6	G	A/B/F	—	A/B/E	—	—	—	NA
Thomas*	1979	13	M	A/C	A/C/H	—	C	C/H	—	.89
Twomey*	1976	11	M	A/C	—	A/G	A/G	—	G	NA
Utzerath	1975	6	M	A/E/G	—	E/H	A/H	E/H	—	NA
Warfield*	1982	9	M	B/C/H	—	C/E	B/C	—	C/E	.95
Williams	1976	6	B	A/B	none	none	A/B	—	F	NA

TD = teacher-directed settings and NTD = non-teacher-directed settings.
*Study done in a special education class.
NA = data not available.
—indicates that data were not gathered in the condition shown.

reported style B as a problem remaining during reinstatement (a success rate of 83%). The success rate for style C pupils was 67% and for style D, 75%. The frequency of visible CASES styles under each of the four conditions, along with the success rates in those cases where undesirable behavior styles were targeted, are shown in Table 15.

Most teachers selected pupils showing styles A, B, C, or D for behavior change. Apparently, these four behavior styles present teachers with the greatest difficulty in the classroom. Of equal if not greater concern should be style H (conforming, passive, submissive) behavior. Data from both types of settings indicate that students displaying style H behaviors, although accepted by teachers, perform less well academically, have lower self-concepts, have negative interactions with teachers, receive lower behavior grades, and experience less cohesiveness with peers.

The effects of a treatment cannot be discovered if the treatment is not correctly implemented by the classroom teacher. Some teachers were unable to follow the recommended procedures, either because of a lack of self-

Table 15

Frequency of Visible CASES Styles Under Four Conditions in 32 Studies

Style	Baseline f	Treatment f	Reversal f	Reinstatement f	Success[a] Rate
A	18	8	18	0	100.0%
B	12	2	11	2	83.3%
C	12	6	6	4	66.7%
D	4	2	2	1	75.0%
E	10	12	3	13	
F	2	6	1	6	
G	5	12	11	16	
H	6	8	7	8	

[a] Rate indicates success of treatments in studies where styles A, B, C, or D were targeted for reduction.

awareness and control over their behavior or because of a reluctance to carry out the treatment as designed. Some teachers were philosophically opposed to elements of the recommended procedures; others were unable to gain sufficient control of their behavior in the classroom to be able to present the specific elements of the complete treatment schedule.

One approach to this problem, and one useful in teacher training, is the use of a teacher-behavior instrument to identify the teaching behaviors consistent with the planned treatment and those inconsistent with it. The second line of research, that of measurement of teacher behavior in the classroom, becomes relevant at this juncture. In the beginning (1959-62), my classroom research focused on the teacher. That work was set aside while an instrument to measure relevant dimensions of pupil behavior was developed. With the CASES instrument fully developed and the seven treatment schedules validated, the need for a companion instrument to assess teacher behavior became more imperative. That work is now well underway. A preliminary report on the new instrument, entitled the Spaulding Teacher Activity Recording Schedule (STARS), is given in a recent issue of the *Journal of Educational Research* (Spaulding 1982). At this writing, the STARS instrument has been found highly reliable and has been used in teacher training programs in special education and elementary education at San Jose State University. Additional reports on teacher training using CASES and STARS will be forthcoming. One study now in progress was designed to test the effects of a CASES-based, whole-class, behavior-management program in a San Jose high school. Preliminary findings show a significant improvement in student coping behavior and concomitant gains in reading achievement. Work is also underway to improve the efficiency of the data gathering and scoring processes, as well as the procedures for training teachers in the use of a whole class approach in which all seven treatment schedules are orchestrated.

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Diagnosis and Evaluation in Mathematics Instruction: Making Contact with Students' Mental Representations

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Mathematics education, once considered a backwater on the intellectual map, has become a serious and important field. For something like three decades now, we have had people with first-rate minds and strong educational backgrounds entering the field—people like Herbert Simon, Marvin Minsky, and Seymour Papert. In foreign nations, one could add the names of Otte, Keitel, Howson, Varga, Krutetskii, and Freudenthal to the list. In this paper, I shall address two questions: First, has this influx of talent changed anything? And, second, will any of this work actually improve education?

Has Anything Changed?

The most conspicuous change has been the emergence of the so-called "alternate paradigm" or alternative strategy for conducting research. Where earlier research focused mainly on "right" vs. "wrong" answers, usually on multiple choice tests, the alternate paradigm is less interested in the student's answer and more interested in the analysis or thought process by which the student arrived at that answer. This is a major distinction. An automobile mechanic is not so much interested in the fact that your car won't start. His interest, quite properly, focuses on *why* the car won't start. Using jumper cables to the battery will be no help if the problem is that the car is out of gas.

Does it make sense to focus on right vs. wrong answers as earlier research usually did? On the surface, it sounds eminently reasonable; the right-or-wrong-answer approach promises economy of resources and, perhaps more importantly, possesses great intellectual simplicity.

But serious reflection raises doubts. Critics of this approach have never been lacking. Indeed, the remarkable career of Jean Piaget grew out of his conviction that IQ testing made a fundamental error when it concentrated on right vs. wrong answers, and ignored the *reasons* why people selected different answers. More recently, Soviet psychologist V. A. Krutetskii (among others) has sharply criticized research based only on answers and ignoring the processes that produce the answers (Krutetskii 1976).

Piaget's precedent and Krutetskii's criticism went without response in the United States for a surprisingly long while, but in recent years the alternative paradigm has emerged. It stresses process as well as product and relates observations to a postulated conceptualization of human information processing. Data are often obtained from task-based interviews. A student or expert is asked to solve a problem while one or more observers watch and perhaps ask occasional questions (such as: "Would you *always* multiply there, or would you sometimes do something else?" or "How did you decide what to do first?" etc.). The postulated conceptualizations owe much to artificial intelligence (or "complex information processing") and cognitive science.

Not surprisingly, a new view of how to study mathematical performance has paralleled the emergence of a new view of the nature of mathematics itself, and also of the new ways that mathematical knowledge is used in today's society. When most users of mathematics performed repetitive tasks in a routine way, it made sense to think of mathematics as a specific, well-defined collection of explicit techniques and to test skill in the performance of these specific techniques. Nowadays, routine, repetitive uses of mathematics are becoming less prominent—they can usually be automated advantageously—and less routine performances are becoming more common. Mathematicians and physicists have always been concerned with nonroutine mathematics. Today, even office workers often are more concerned with this form of mathematics. The moment one employs machines, either calculators or computers, much of the routine work is removed from humans, but nonroutine demands increase: Every new calculator or computer is likely to introduce an element of novelty, so that the ability to deal effectively with novelty becomes more important than the ability to deal effectively with repetition. What machines do, humans must do.

It is easy for those of us who are close to mathematics and science to underestimate the profound change this implies for those who are not so close. For most office workers, trades people, parents, and pre-college teachers, *mathematics is defined as a specific collection of explicit algorithms*. They think of it in no other way.

Even when curriculum modernization causes a teacher to enlarge the specific collection of techniques, the teacher will not usually change his or her epistemological view. Math will still be perceived as a fixed collection of explicit algorithms. The adequacy or correctness of this fundamental view is one of the basic questions in mathematics education today. We shall see it reflected variously in what follows.

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How else can one view mathematics? Those who are close to mathematics typically see it as:

A. An open-ended collection of techniques. (You are free, and *feel* free, to devise new and better techniques whenever you can.)

B. A complex form of information processing that includes:
   1. Creating representations for problems, mathematical situations, knowledge, etc.
   2. Difficult tasks in selection and retrieval from memory.
   3. Heuristics.
   4. Setting goals and subgoals.
   5. The use of meanings in constructing or revising algorithms.
   6. The use of nonalgorithmic knowledge such as principles, etc.

For readers interested in details, the preceding generalities about the nature of mathematics may be illustrated by specific examples:

Representations. Stephen Young (1982) has demonstrated how a mathematics problem may be easy if one representation is used, or difficult if another representation is used. It is well-known that

$$I = \int_0^\infty e^{-x^2}\,dx$$

is a difficult problem in this form, but if I^2 is represented in polar coordinates, one easily finds that

$$I = \tfrac{1}{2}\sqrt{\pi}.$$

As Young showed, this phenomenon goes much deeper. Young used this fact concerning representation to develop a detailed explanation of why, on each of two recent PSAT tests, problems coded with wrong answers sneaked past experts, only to be solved correctly and confidently by neophytes.

Indeed, Young went even further, showing how alternative representations may be built from simple concepts learned in everyday experience.

An open-ended collection of algorithms. One instance of a student inventing a new algorithm was reported by Barson, Cochran, and Davis (1970); many other instances have been reported. (See Suzuki 1979; Kumar 1979, or the series of studies on addition carried out by Resnick et al. 1978.) Any experienced mathematics teacher sympathetic to students' originality will have seen many more.

Heuristics. The importance of heuristics is well-known (see Polya 1965; Davis, Jockusch, and McKnight 1978).

The willingness to use nonalgorithmic knowledge has emerged as one of the differences between expert and novice performance. Experts use nonalgorithmic knowledge; most students do not. For example, consider the following problem from a calculus book:

> A rope with a ring in one end is looped over two pegs in a horizontal line. The free end, after being passed through the ring, has a weight suspended from it, so that the rope hangs taut. If the rope slips freely over the pegs and through the ring, the weight will descend as far as possible. Assume that the length of the rope is at least four times as great as the distance between the pegs, and that the configuration of the rope is symmetric with respect to the line of the vertical part of the rope. (The symmetry assumption can be justified on the grounds that the rope and weight will take a rest position that minimizes the potential energy of the system.) Find the angle formed at the bottom of the loop.

In task-based interviews, Davis (1983a) found that two students in a class of 22 saw this as a problem involving a *principle*—that the weight will descend as far as possible, or that its height will be a minimum—and were thus able to solve it. Other students tried in vain to recall a *formula* that would give the solution. (No explicit general formula exists, but the applicable principle is stated twice within the statement of the problem.) Beginning students are strongly disposed to view mathematics as a specific collection of formulas and algorithms, a phenomenon which requires further study. It is true that these students typically have had teachers who viewed mathematics that way, but this fact does not establish cause and effect. Do students acquire this view from their teachers (which would be no surprise)? Or is the algorithmic view so natural for beginners that students have compelled their teachers to see (and teach) mathematics that way? Certainly, many students are not easily induced to abandon the algorithmic approach. (See Davis 1983b, in preparation.) A persistent difference between novices and experts is the tendency of novices to see their work as a sequence of small steps, often neglecting well-known meanings (Davis and McKnight 1979). Experts, on the other hand, see larger "chunks," more often in the form of principles or typical situations or problem types. Clearly, some of this difference is inevitable, but the observed differences often seem extreme, and may result from learning experiences that neglect larger patterns in favor of a sequence of small steps (Beberman 1958; Larkin, McDermott, Simon, and Simon 1980).

Back to the Business at Hand

I must remind myself that our present topic is diagnosis and evaluation in mathematics. Most readers will not want to plunge into the question of what mathematics really is. Nonetheless, for all readers, it is important to summarize briefly the preceding section:

Mathematics once meant carrying out some specific calculations in a specified way—at least for most people it did. This is not the case today. Anyone who has come to use computers knows the difference. Nowadays, the premium is on learning new things—new to everybody, not just to children—and on being able to make effective use of this new knowledge. A person with a prodigious memory who was a diligent student in school 25 years ago would not necessarily be able to deal with a computer today—not, that is, unless he or she had also acquired skill in learning mathematical material, in dealing with mathematical situations.

I am well aware of the conflicting pressures that this puts on American education. Many parents and teachers want to get "back to basics," by which they often mean rote learning of traditional algorithms. Yet no one within the math-using community—mathematicians, engineers, scientists, and so on—believes that such an educational program will lead to a generally competent, employable population. It is as if one tried to replace the study of journalism or creative writing with a curriculum that dwelt upon spelling and vocabulary drill. No one opposes correct spelling, but spelling correctly will not, by itself, make you a successful writer. In the same way, it is nice to know long division (even though it is no longer actually essential because a calculator will give you the answer), but knowing long division is only a tiny part of what it takes to become an engineer. You must also deal well with mathematical situations, including novel ones.

I have spent more space than I had intended on the nature of mathematics itself, primarily because disagreements over what math is will continue to be a source of trouble, both for schools in general and for diagnosis and evaluation in particular.

For the rest of this paper, I will assume that when we say a student is good at mathematics, we mean that he or she deals with a wide range of mathematical situations powerfully and flexibly. This includes coping with things that may be novel and unexpected. Understanding what you are doing is an important part of this capability. That student who has only rote knowledge of explicit techniques will usually not be good at mathematics in this sense. You do need to know mathematics, but you must also be resourceful in how you use that knowledge.

I wish we did not have to struggle over the complication of two conflicting views—diametrically opposed views, one might say—concerning the nature of what you need to learn when you study mathematics. But at present, there seems no way to banish the conflict.

Research Result One: We're Teaching Rote

Partly, I wish the conflict would disappear because I know that, as a broad generality, our schools do not succeed in teaching a powerful, flexible approach to mathematics. What we teach, mostly, is rote.

This sad fact sounds loudly through a large body of research and observation (Fey 1979; Stake et al 1978; Schwab 1964; Dennison 1969; Bruner 1962; Papert 1980). Observations of classrooms show clearly that what is typically taught is highly verbal, highly explicit, and very fact oriented. We typically teach, "This is called the *abscissa*; this is called the *ordinate*," but we do not, for example, give students experience in using graphs flexibly in response to novel challenges. We do not give students experience in inventing their own strategies in order to attack new types of problems.

The microcomputer has, in a small way, changed this for some students, though not, of course, when the device is used for drill and practice. In that role, the computer usually shows its worst side, increasing the emphasis on rote learning, leaving less room for creativity and originality.

However, given a choice, students do not seem to use computers for drill and practice. Students in Urbana, Illinois, mostly prefer to learn to program the computer, to control it, to make it create interesting displays on a plasma panel or CRT. When used this way, the machine challenges children's ingenuity, requires that they invent strategies and lines of attack, and demands thoughtful analysis of one's efforts.

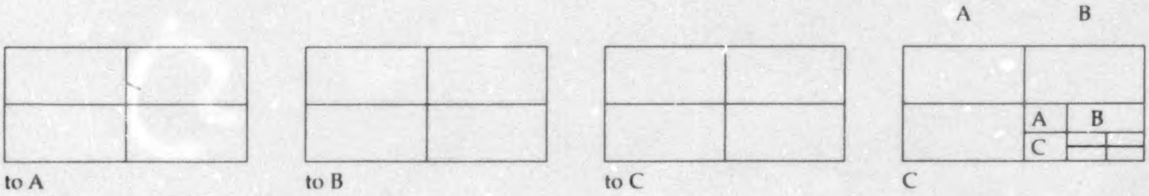
But where I have observed it, this tendency is usually the success of the *machine* (that happens to be located in a school) and not a success of the *school*. The broad generalization remains true: Our schools mostly teach rote aspects of mathematics and neglect strategy, analysis, heuristics, decision making, intuition, flexibility, and creativity. In art, the parallel would be to teach students to paint "by the numbers," rather than to analyze and create art.

From the point of view of diagnosis and evaluation, this problem suggests that we must identify what we want to diagnose and evaluate. Too often our work in diagnosis and evaluation serves to tie us more tightly to a rote curriculum, making it harder to build creativity and challenge into schoolwork.

Research Result Two: Students are Creative

As I assembled research results for this paper, I found an interesting mixture of good news and bad news. Research Result Two is good news: Typical students *are* creative and resourceful in situations with which they are familiar, and many of them bring this resourcefulness to bear on mathematics if the subject is taught to them in a meaningful way. Two excellent studies dealing with this are Kieren, Nelson, and Smith (to appear), and Lave, Murtaugh, and de la Rocha (in press). Kieren, Nelson, and Smith asked students to solve problems involving fractions and division. A novel and important aspect of this study was that it allowed the use of graphical or pictorial methods. Given a realm where they could be creative, a group of average students were very resourceful indeed. Consider one student, an eighth

Figure 1



grade girl, who was asked to divide four rectangles ("candy bars") equally among three people. The student solved the problem by drawing the diagram shown in Figure 1.

In effect, the student determined that

$$4 \div 3 = 1.1111 \text{ (base 4 numeral).}$$

This child could not have solved the problem using conventional abstract notions, but in a setting where all of her "real world" knowledge (about dividing into halves, or halves of halves, etc.) could be brought into play, she was able to solve the problem with unexpected ingenuity.

In the second study, Lave, Murtaugh, and de la Rocha reported the contrast between the unsuccessful efforts of some adults to solve some mathematics problems theoretically vs. their success with similar problems in practical settings such as supermarkets or their own kitchens. (One man's diet called for him to eat three-fourths of the cottage cheese in a cup that was two-thirds full. He spread out some wax paper, arranged the cottage cheese on it as a disc, marked two perpendicular radii, thus getting fourths, and ate three of them.)

To be sure, in both the Kieren and Lave studies, you do not see traditional algorithms used in traditional ways. You see ingenuity and resourcefulness, both central to effective performance in mathematics. Many teachers and evaluators might view these performances negatively. They would be wrong. Both the girl and the man displayed an effective and appropriate—though nonalgorithmic—way of dealing with the problems. Both studies presented evidence on which educational programs could and should build.

The British report *Mathematics Counts* (Cockcroft et al. 1982) showed similar examples. Assigned to multiply 7 × 96, one boy proceeded as follows:

$$3 \times 96 = 288$$

$$\begin{array}{r} 288 \\ +\underline{288} \\ 576 \end{array} \qquad \begin{array}{r} 576 \\ +\underline{\ \ 96} \\ 672, \end{array}$$

an excellent demonstration of resourcefulness and understanding. Consider also this example (which, like the preceding example, came from a study at the University of Bath; the subject was described as a "craftsman" of unspecified age but obviously an adult): Needing to add

$$3/16 + 5/64,$$

the "craftsman" did not use the addition algorithm taught in school, but drew on personal knowledge of fractions, and some ingenuity, to solve the problem as follows:

$$\begin{aligned} 3/16 + 5/64 &= 3/16 + 1/16 + 1/64 \\ &= 4/16 + 1/64 \\ &= 16/64 + 1/64 = 17/64. \end{aligned}$$

Whether we deal with task-based interviews, or diagnosis in general, or evaluation in general, or design and implementation of curricula, *we must be continually aware of the importance of ingenuity and creativity in mathematics. Successful, even powerful, performance in mathematics is not primarily a matter of conformity. It does, however, depend upon understanding and resourcefulness.*

To put matters simply: Don't evaluate student performance in terms of compliance with your preferred method of solution. Respect any good idea or technique.

Consider this work by a third grade boy in Weston, Conn. (Barson, Cochran, and Davis 1970):

$$\begin{array}{lr} \text{Problem:} & 64 \\ & -\underline{28} \\ \\ \text{Solution:} & 64 \\ & -4 \\ & \underline{40} \\ & 36 \end{array}$$

Although reading and writing lie outside the domain of this paper, it seems relevant to report here a parallel phenomenon noted in studies of how children learn to write. Many children are very resourceful, and advance further than adults believe, because adults do not observe carefully. Temple, Nathan, and Burris (1982) reported the case of a 4-year-old girl who claimed she could write. She drew a person fishing, and scribbled some "writing," which seemed to be:

Yuts a lade yet feheg ad he kot flepr.

One could have easily dismissed the girl's claim that she could write. Yet, when an interviewer asked her what she had written, the girl read it as:

Once a lady went fishing and she caught Flipper

(See also Hechinger 1982; Graves 1982).

Clearly, this child had made significant progress in writing. Her performance suggested a foundation on which schools could build. The question then is: Will schools build on this foundation, or ignore it?

Research Result Three: Schools Ignore Creativity

Research Result Three may be stated briefly: Most of the time, schools' instructional programs will not recognize children's creative accomplishments but will tend to brush them aside. Typically, evaluation will not look for accomplishments but rather for conformity to a prescribed pattern of performance. (See Ginsburg 1977; Hechinger 1982; Dennison 1969.) Erich Fromm's book, *Escape from Freedom* (1941) contained observations on schools, such as: "From the very start of education original thinking is discouraged and ready-made thoughts are put into people's heads." Fromm would probably not change his theme were he writing today. (Indeed, similar views on schools in Urbana, Illinois, have recently been expressed in letters to the editor of *The Daily Illini*, the newspaper published by students at the University of Illinois. (See Shadix 1982.)

One of the most difficult tasks in analyzing a student's level of skill, knowledge, and understanding is to give the student proper credit for ideas and methods that are unorthodox or unexpected. The evidence is that all children have such insights, which are often correct and potentially powerful (Groen and Resnick 1977). The problem is for the interviewer or diagnostician to recognize such insights and for the schools to build on them.

Research Result Four: Students are Confused about Mathematics

The following may sound like bad news, but I am convinced that the studies described in this section offer grounds for optimism.

Let's start with some of Erlwanger's results. Using task-based interviews, Erlwanger (1973) found that a sixth grade student, Benny, believed by the teacher to be successful, in fact was seriously confused about arithmetic, had many stable ideas that were also wrong, and regularly used faulty algorithms and obtained incorrect answers. For example, Benny converted 2/10 to a decimal as 1.2. Then Benny added

$$2/1 + 1/2$$

and got an answer of 1. Benny also said that .5 could be written as

$$3/2$$

or

$$2/3,$$

which Benny asserted were equal. For the sum .3 + .4, Benny got the answer .07. All of these wrong ideas proved stable, consistent, and extremely resistant to remediation.

Benny's case was typical of the students Erlwanger studied. In every case, students

- were studying a formalistic system of one kind or another;
- were thought to be successful;
- and turned out to have gross misconceptions at a fundamental level.

Clement and Rosnick (1980) studied students at the University of Massachusetts and found the following:

> Task: At a certain college, there are six times as many students as there are professors. Write an equation to express this fact, using S for the number of students, and P for the number of professors.

A sizable percentage of students—the precise percentage depends upon which population of students you consider—wrote

$$6S = P.$$

A casual error? Careful, task-based interviews showed that it was not. Here, too, the students clung tenaciously to their wrong ideas and resisted attempts at remediation. (The details of this study, actually a sequence of related studies, are fascinating. See Rosnick and Clement 1980; Lochhead 1980; Davis 1980.) *These students had, in many cases, "successfully" completed ninth grade algebra, the study of quadratic equations, systems of linear equations, and the graphing of conic sections—all of which depend upon the use of variables—and yet they had fundamentally wrong ideas about how variables work, in even the simplest of examples.*

Other studies by diSessa (1982) with students at a major engineering school, McCloskey, Caramazza, and Green (1980) with students at a major university, and similar studies elsewhere show the same general pattern. All of this raises several questions:

1. How can such severe misconceptions escape detection by teachers or by the usual evaluation programs?
2. How have the students managed to survive so long (some were college students in engineering!), burdened with so much incorrect information?
3. Why do the students have so much incorrect knowledge?
4. Why is this incorrect knowledge so resistant to change?
5. How can one reconcile this apparent evidence of gross stupidity with the picture of creative, resourceful students depicted by Research Result One?
6. Finally, why do I see these and the other so-called "disaster studies" as reason for cautious optimism?

Let me sketch some answers to these questions:

1. Why these errors escape detection is poorly understood at present. In some cases, the cause seems to be the absence of certain distractors on multiple choice tests. In other cases, the difficulty of detecting the errors is a tribute to some students' shrewdness and resourcefulness. In some cases, it shows what can and cannot be accomplished by studying late the night before an exam, even though one may forget much of the material by the next week.
2. The students seem to survive because they learn enough—perhaps barely enough—of the formal rules and procedures so that they can continue to make some kind of progress. (Of course, most of this "progress" is an illusion. The fact is that these students are badly confused and often wrong even in simple matters. This, of course, is mainly an indictment of the curriculum and typical methods of instruction.)
3. The reason why the students are so badly confused is more complex. Growing evidence (Davis 1983a) indicates that complicated ideas in mathematics are developed by piecing together simpler ideas in an essentially metaphoric way. Even complicated ideas are actually elaborate constructions made from such simple, 'concrete' pieces as the ideas of *up, down, next, connected to, interchanging, move, remain unchanged,* and so on. When these pieces are properly put together the process is called *assembly* or *assembling,* one gains a secure and powerful kind of knowledge. This includes what is often called "intuitive knowledge" or "having a gut feeling."

   However, it is possible to bypass the assembly process and to create formalistic knowledge of verbal statements (that can be memorized and repeated without necessarily being understood) and rote algorithms. Many curricula today do precisely this. When this happens, students' knowledge is fragile and superficial, allowing room for severe misconceptions.
4. Why much of this incorrect knowledge is so resistant to change is a technical matter. (See, for example, Davis 1983a.) Roughly, it is because the "wrong" ideas are not totally wrong, and the student has invested great effort in integrating these ideas into the larger framework of his or her other ideas about mathematics. The tapestry as a whole hangs together rather well, even while wrong in many key places (Erlwanger 1973).
5. Are we saying students are clever (as Research Result One seemed to claim) or stupid (as Research Result Four seemed to suggest)? I believe that both results are remarkably consistent: *Both show that students think for themselves.* When teaching and evaluation procedures recognize a student's ideas and build on them, or when we are lucky, the fact that students insist on thinking for themselves is very helpful; we see students make genuine progress. When teaching and evaluation procedures stress conformity to "official" ways of analyzing problems, when they fail to make contact with students' ideas, then students' insistence on thinking for themselves may result in students developing misconceptions and wrong methods.
6. Why do the disaster studies give reason for optimism? My view is this: Observant teachers at various levels (including engineering school) have long realized that many of their students do not really understand the mathematical content. To a greater or lesser degree, these students are faking it or just getting by. But until the disaster studies, all that teachers had was a vague feeling, bolstered by quantitative results such as test scores but lacking specific detail. Prior to the discovery by Lochhead et al. that many students—37% of engineering students in one study and 57% of social science students in another—got the 6P = S equation wrong, probably nobody suspected that students' misconceptions ran so deep. And prior to Clement and Rosnick's (1980) demonstration of student resistance to remediation, probably nearly everyone would have considered the students-professors error a mere slip. On the contrary, the error is part of a deep seated, firmly held set of serious misconceptions.

   The first step toward remedying this situation had to be a probing of the true dimensions and nature of the problem. With the disaster studies, this probing is now underway.

   My optimism is also partly due to the fact that some of these studies were performed by university physics departments, employing cognitive psychologists to find out why students experience such difficulties with mathematics. Nothing of this sort could have happened until authorities became interested in what was going wrong. Apparently, this is beginning to happen.

Research Result Five: Complex Ideas Derive from Childhood Learnings

A long sequence of studies indicates that a new idea—that is, a new mental representation for some knowledge—is created by using one or more previously built representations, with some revisions if necessary, in a fashion that is essentially metaphoric. How did we create a mental representation for an atom when we were confronted with the Rutherford scattering data? We made use of the mental representation we already had for the solar system, identifying the atomic nucleus with the sun, and the orbiting electrons with the planets. Then, of course, we had to adjust the picture somewhat: The planets' orbits lie roughly in the same plane; the orbits of electrons do not. The planets attract one another; electrons repel one another. Electrons are arranged in layers; the planets are not, and so on.

The point is, metaphors are built on top of predecessors, which were themselves built on top of their predecessors, and so on, rather like Rome. One can often trace things, and find that a quite sophisticated mathematical idea is built, ultimately, out of pieces of ideas learned in early childhood.

How can one study this phenomenon? Answer: in many ways, a few of which we will review here.

First, we can establish that a large portion of mathematical knowledge is stored in the mind by means of representations that are not verbal and are not statements.

David McNeill (1982) of the University of Chicago videotaped mathematicians talking to one another. In one interview, Mathematician A is explaining something to Mathematician B, who obviously has a strong general knowledge of the area in question. The earlier part of the interview established that A has some unconscious gestures. Whenever he says "inverse limit," he rotates his right wrist as if he were turning a screw. When he says "direct limit," he extends his right hand outward, somewhat like a salute. What makes this interview interesting is that, in the second half of the interview, Mathematician A makes several slips of the tongue, saying "inverse limit" when he means "direct limit," and conversely. In each case, B corrects him and A acknowledges the correction.

However, in every case when the wrong *phrase* was uttered, the correct unconscious *gesture* was employed, so that, in these cases, the phrase did not match the gesture. Clearly, A's internal information processing used a representational system different from his words, and only in a later stage was the representational knowledge converted into natural language statements (pp. 18-19).

More direct evidence for this same conclusion has been reported by Marshall (1982), Marshall and Newcombe (1966), and Newcombe and Marshall (1980). These researchers studied patients with brain lesions that blocked communication within the brain. For some of these patients, internal processing was unimpaired, but communications between some language functions were blocked, making it possible to get a more direct view of the internal processing itself. For example, in one form of disorder, patients read the printed symbol "glad" as "happy," believing that they had read it correctly.

Another way to study this phenomenon of assembling early childhood ideas in complex ways to create representations for the concepts of advanced mathematics is to come at the problem from the opposite direction, to observe how language is used. Many valuable studies have demonstrated that ideas of mathematics, physics, and even life in general are expressed in concrete metaphors dealing with moving, touching, counting, staying in place, up, down, heavy, light, etc. Many especially interesting studies have been conducted by Dedre Gentner (1980a; 1980b; 1982). One study (1982) reported on language used in American newspapers, showing that abstract or intangible matters are often described as if they were tangible matters of the type that a child meets in the first five or six years of life. For example:

- "Because he had previous convictions for perjury, the jury gave little weight to his testimony."
- "The burdens of the office seemed to weigh heavily on the President's shoulders."
- "He stuck fast to his contentions and refused to be shifted."

One can study the role of metaphors in the representation of other areas of knowledge. Quinn (1982) studied people's discussions of marriage, most commonly represented as a journey, container, room, or enclosed space ("affairs *outside* of the marriage"), or as a valuable product ("to build a good marriage"), or as a contract, agreement, or job ("not doing his/her share"), or as one of a few other common metaphors. In addition, Gentner (1980a, 1980b, 1982) provided several fascinating studies on metaphors used for quantities or situations in physics and engineering.

The fundamental role or representations drawn from early experiences—even when one is dealing with extremely abstract and complex matters—is not mysterious. How would you explain one-to-one correspondence to someone who is not a mathematician? How would you explain continuity of a function $y = f(x)$? How would you explain the addition of e.m.f.'s when batteries are connected in series? Most likely, you would draw on concepts or relationships first experienced in childhood.

The constructivist view of mathematics *is* something new—at least to most people. While metaphors have, in the past, often been regarded as conveniences in interpersonal communication, the constructivist sees them as far more basic: "Primitive" metaphors are essential parts of one's internal representations of abstract ideas; they aren't just "communication," *they are how you think about these things* (Lakoff 1982).

This view holds an important implication both for curriculum and for diagnosis and evaluation: The job of an instructional program is to make solid contact with the mental representations that a student already possesses and to provide those experiences and interpretations that will help the student develop his or her representational capability further, hence becoming able to represent more complex mathematical situations and mathematical knowledge.

Little present school practice comes close to this. On the contrary, schools are typically highly verbal, even though the most important mental representations are mainly nonverbal.

Research Result Six: Consistent Errors Signal Misunderstanding

Research Result Six is that student errors are often systematic and consistent and often give precise information on what the student is doing wrong. Erlwanger's (1973) student who converted

2/10

to a decimal as 1.2, also made the following conversions:

4/10 → 1.4
10/4 → 1.4
5/21 → 2.6.

Clement, Matz, Brown, and Burton (1978), Brown and Van Lehn (1980), Friend (1979), and Davis, Jockusch, and McKnight (1978) reported similar consistency in student errors. Careless or accidental errors do occur, but the more common kind of error, and the kind that the teacher can and should do something about, is the consistent error than indicates a misunderstanding or wrongly represented algorithm. Perhaps the definitive research paper on this subject is Van Lehn (1982).

Research Result Seven: Representations Determine Problem-Solving Ability

Research Result Seven concerns the specific mental representation for a specific problem or piece of knowledge, which an individual student builds in his or her mind. Of course, you could say that this topic has lurked beneath the surface of nearly everything discussed thus far in this paper. You would be correct. But representations are so important that they deserve explicit mention by themselves. It is difficult to help a student past an obstacle unless you know how the student represents the task, or the data, or the relevant knowledge that must be used. Three especially important reports on this subject are "Representation and Understanding" (Bobrow and Collins, eds. 1975); "The Mental Representation of Geometrical Knowledge" (Young 1982); and "Some Demonstrations of the Effects of Structural Descriptions in Mental Imagery" (Hinton 1979). Young, for example, considered a well-known test question on a College Board examination—a question that all the experts answered incorrectly but that a student in Florida quickly solved. Young demonstrated that answering incorrectly is almost inevitable if you represent the problem data in one way; but if you represent the data in a certain alternative way, you will almost certainly see the correct answer immediately. It is not a question of intelligence; it is merely a question of which representation one builds in one's mind.

For teachers, there are the obvious diagnostic implications: Try to determine how a student is representing the data. Do not view sudents as merely solving homework problems correctly or learning to imitate algorithms correctly. *View them as building up complex representations in their minds.*

Research Result Eight: Students Solve Problems by Stimulus-Response

Research Result Eight deals with whether students *understand* the mathematics they study. The research is clear on this point: *The vast majority of students do not understand the mathematics that they are supposed to be learning.* Alderman et al. (1979) reported that only three students in a class of 24 fifth graders could give any sensible meaning to the multiplication 4 × 5. Correct answers would have included interpreting it as 4 piles of 5 washers, or the number of cupcakes in a pan that had 4 rows and 5 columns, or the area (in square inches) of a rectangle 4 inches by 5 inches, or how much money you would earn if you were paid $5 an hour and worked 4 hours. A majority of the students knew that when you are presented with 4 × 5, you answer 20—but this was literally a stimulus-and-response reaction, not anything that deserved to be called question-and-answer, because *question* and *answer* imply meaning, understanding, and analysis, none of which were present except in three students. (Alderman et al. tested other students in other classes, and obtained similar results.)

If this strikes you as weird, here is a test you can carry out yourself: Ask adults of your acquaintance (not math teachers, though—that isn't fair!) to give a meaningful interpretation of

$$1/3 \div 1/2.$$

To make sure they understand what you are asking, work through some similar problems with them. For example, given the starting point

$$2 \times 3,$$

you could respond with a story, such as: "How much will it cost to buy two tickets if each ticket costs $3?" If you were given the starting point

$$6 \div 2,$$

you could make up the story, "I have six cookies and I want to share them equally between two people. How many should each person get?"

When you are sure your friend sees the nature of the task—starting with a mathematical expression and making up a story to match that expression—then ask the friend to make up a story to match

$$1/3 \div 1/2.$$

If your experience is typical, you won't get a correct answer. What you may get will be something like this: You have a third of a cup of milk and you want to share it equally between two kittens. How much does each kitten get?

This story, of course, is wrong. It does not match

$$1/3 \div 1/2.$$

What it does match is

$$1/3 \div 2$$

or

$$1/3 \times 1/2.$$

Is it possible your friend doesn't know the difference between

$$1/3 \times 1/2$$

and

$$1/3 \div 1/2?$$

Or between

$$1/3 \div 1/2$$

and

$$1/3 \div 2?$$

Notice that I am not saying your friend won't know that

$$1/3 \div 1/2 = 1/3 \times 2/1 = 2/3.$$

Many people know that. But again it is a matter of stimulus and response. For most people, there are no questions here and no answers, because questions and answers require meaning, thought, and understanding, and most people cannot relate the problem

$$1/3 \div 1/2$$

to any sensible meanings: *They do not understand!*

Other studies in this same direction include Davis and McKnight (1980) and the previously cited work of Erlwanger. See also Davis, Young, and McLoughlin (1982).

Clearly, we must be cautious in assessing student achievement and perhaps even more cautious in assessing the effectiveness of an educational program. As Alderman et al. pointed out,

> "When major curriculum programs result in improved student performance on traditional tests, it may be especially appropriate to examine more closely the nature of these treatment effects.... With such treatments...there is a risk that students simply become proficient in taking tests or learn mathematical concepts peculiar to the exercises presented within the curriculum." (pp. 3-4)

In a later section, we shall return to the question of whether genuinely superior educational programs are available.

Research Result Nine: Mental Tasks in Mathematics are Diverse

Research Result Nine is this: There is a greater diversity in the kinds of mental information processing needed in mathematics than most people imagine. The man on the street—or person on the street—probably thinks that mathematics depends upon being able to memorize certain kinds of things—formulas, number facts, definitions, algorithms, and so on—and being able to use them with precision when necessary. Careful observation and analysis shows that a vastly larger array of kinds of processing is actually required: recognizing patterns in input data; creating representations in one's mind; recognizing similarities between seemingly dissimilar items; creating a meta-language to permit thinking about the processes of mathematics themselves and also about the entities of mathematics; creating "abstractions" by eliminating nonessential details; developing strategies for more effective memory searches; and many more (Davis 1983; Matz 1980). Being good at mathematics means much more than merely knowing a few algorithms and being able to use them.

Research Result Ten: Students Can Understand

Research Result Ten constitutes the real challenge. We have good data (Dilworth 1973; Benbow and Stanley 1982a, 1982b; Davis, Jockusch, and McKnight 1978; CBMS 1975) indicating that *many students (nearly all of them, in fact) can learn substantially more mathematics than they presently do—and this means learning with understanding*. There is no secret to this; a variety of improved curricula have demonstrated abililty to produce such results, provided that adequate inservice teacher education is included as part of the package. (See especially CBMS 1975, pp. 93-4.)

Conclusions

Notice that the blend of good news and bad news presented in this paper involves no contradiction. Where a curriculum is formalistic, focused narrowly on rote algorithms, and delivered mainly verbally and without attention to making contact with the ideas of students, the results will be unsatisfactory. The students will, as always, build up their own knowledge representations, but many of these will be wrong and will impede further learning.

But when a curriculum deals respectfully with the wide range of kinds of information processing required in good mathematical thinking, when contact is made with a student's ideas, when experiential learning opportunities go beyond the usual, purely verbal approach, and when the pacing, notations, and sequencing are well designed, the vast majority of students demonstrate that they are capable of learning much more than had previously been expected.

This clearly does not mean that any new program of instruction will lead to substantially greater learning by most students, nor that any commonly used measures of achievement are appropriate for making judgments (remember Alderman's concerns), but there do exist programs where students learn more. The cognitive abilities of typical students are not the limiting factors on what most students learn.

Any question of diagnosis or evaluation of student performance is two-sided, although we do not always view it that way. We are always asking: "How well is the curriculum serving this student?" I think we must never operate on the assumption that the curriculum is perfect or unchangeable. I hardly ever see a student who is having trouble without asking myself what changes in the curriculum might have avoided the trouble in the first place. I argue that the profession of teaching must take this point of view. If teachers do not accept responsibility for the curriculum, they give up a major part of their professional role.

Physicians have been severely criticized in some circles for their lack of concern for health maintenance. It is argued that doctors often ignore health-destroying situations, waiting until a serious problem occurs, which they then try to treat. I think medicine has improved greatly in this respect—my own doctor now tries to get his patients to use seat belts and stick to a proper diet—but the criticism has some foundation. Teachers must bear similar reproof. When teachers deal with diagnosis and evaluation, they must also deal with the design and implementation of curricula that avoid the creation of problems.

That, however, is mainly another story, and must be the subject of other reports.

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The Development of Language and Literacy: Essential Knowledge for Effective Teaching and Learning

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Oral Language Development: Listening and Speaking

Universals in Language Development

Language, closely linked to the process and product of thought, serves to mediate virtually all learning. For this reason, the development of language and literacy in children is considered schools' first and most fundamental responsibility. Not surprisingly, language and literacy have been the subject of more research than any other aspect of education. Teachers who understand language and literacy development and its implications for the classroom are more likely to make effective instructional decisions.

From infancy, the function of language is communication. While children enjoy playing with sounds and words for their own sake, language develops primarily because it aids interaction among its users. Therefore, from the beginning, language has a social basis as much as a cognitive one.

Children make almost all possible sounds during their first year. Gradually, they differentiate among these sounds and emit fewer sounds, choosing the ones that more closely approximate those used in their language environment.

Language development is systematic and uniform among children. The sequence of words is similar. Early vocabulary appears similar even in different cultures and is not correlated with frequency in adult speech. Common first words are "pa-pa," "da-da," "ma-ma," "no-no," "bye-bye," and infantile words for milk.

Children do not merely imitate speech they hear. They copy directly neither words nor syntactic forms. Instead, they choose from their rich linguistic environment those bits they are ready to experiment with. Studies of children's first two- and three-word utterances reveal that only essential words are used: "dry pants," "see train," "all gone juice." These "sentences" have been termed "telegraphic speech" (Brown and Bellugi 1964) because only high meaning-bearing words are used.

While parental input was first presumed to be the prime influence on the child's language development, studies have shown that the child's speech also affects the parents' speech. Thus, the parent-child *interaction* is now considered the most important influence on the child's language development. In their interaction, both parties seek to be understood. Observations reveal that parents usually do not correct the form of their children's statements but do correct the accuracy of the content. The irony is that drills designed to train directly for form have proved ineffective. On the other hand, correction of content (which is, of course, inextricably linked with modeling of form) does lead to a change in form.

Children enter school having learned a staggering amount of receptive and productive knowledge regarding the sound and syntax of their language. While they may appear to comprehend and even use all linguistic forms, research shows that children are still learning some syntactic forms throughout the elementary years (Chomsky 1969).

Unlike most linguists, who study children's language development with a view toward understanding the acquisition of grammatical structures, Halliday (1975) analyzed beginning speech in terms of the functions or uses to which children put it. He formulated seven functions, listed below in the order they evolve:

1. Instrumental (used to satisfy needs, desires to get things done). *Examples:* I want; I need.
2. Regulatory (used as a means of persuasion, control). *Example:* Do as I tell you.
3. Interactional (used to develop interpersonal relations). *Example:* Me and you.
4. Personal (used to develop self-awareness, express feelings). *Examples:* Here I come; I don't like it.
5. Heuristic (used to explore the nonself environment). *Example:* Tell me why.
6. Imaginative (used to build worlds separate from the world of reality). *Example:* Let's pretend.
7. Informative (used to communicate information to someone). *Example:* I've got something to tell you.

By focusing on the uses to which children put language, Halliday's work has important implications for instruction: Teachers must provide children with language practice that is functional and useful to them at the time of instruction. Such instruction should offer opportunities for children to use language in a variety of settings and for a variety of purposes.

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Differences in Language Development

While amazing similarities in language development exist among children in all cultures, there are variations. Because the study of language development is a new field and because much of the research has been done with extremely small sample sizes (often three or fewer children), good estimates of language variation—as exist for motor development, for example—have not yet emerged. There is some evidence that children do learn language in different ways. For example, Bloom et al. (1975) showed that the early vocabulary of children differs as to whether nouns or pronouns predominate. By the time children demonstrate average-length utterances of 2.5 words (approximately age 30 months), however, this difference disappears. Bloom concluded that while children eventually develop the same competencies, they appear to break into the linguistic system in different ways.

Ramer (1974) classified four children as fast learners and three as slow learners based upon the speed with which they went from using one-word utterances to using the subject-verb-complement form for 20 percent of their sentences. The fast learners learned different sentence forms simultaneously and made more word-order errors than did slow learners. Ramer therefore characterized fast learners as risk takers.

Another important difference related to language development involves the controversy surrounding the language of disadvantaged children. It is usually described as the "deficiency vs. difference" issue. Most often centered on the language of poor, black children, this issue has been investigated for a possible causal factor related to poor reading achievement.

Adherents of the deficiency view describe the language of poor, black youngsters as "nonverbal" or "verbally destitute." The writings and programs of Deutsch (1967) and Breiter and Englemann (1966) are most often associated with the deficit theory.

Among those whose research and writings have opposed this view have been Baratz and Shuy (1969), Loban (1970), and Stewart (1965). Their work confirmed that the language of poor, black children is not a random, primitive, or inferior language, but a nonstandard variety of English reflecting a formally structured linguistic system. Virtually all linguists today concur with this difference theory.

Children learn the language to which they are exposed. The language used by children who are nonstandard dialect speakers, be they poor blacks, Appalachians, or speakers of any other variety of English, is complex and rule governed. It develops at a rate that parallels standard English development. At some point, most nonstandard dialect speakers gradually begin to incorporate more and more standard English into their speech. Research indicates that this happens best when teachers have positive attitudes about nonstandard dialects, have high expectations for children regardless of the dialect of English they speak (Williams et al. 1973), understand students' oral language and know its features and points of variation, and recognize the appropriateness of different speech for different settings and purposes.

Language and Thought

What is the relationship between language and thought? Standardized measures of intelligence—especially measures of vocabulary knowledge, syntactic development, and verbal reasoning—are based on and highly correlated with language development. Educators have attempted to develop children's language in order [illegible] improve their thinking, reading, and general school performance. The theories of Piaget (1955), Vygotsky (1962), and Bruner (1966) are reviewed below as representative of the three most influential and widely held positions on the relationship between language and thought.

Piaget stated his position in *The Language and Thought of the Child* (1926): Cognitive development determines the course of language growth, not vice versa. Thought for the preschool child has roots in action, not language. Language is used to transmit what has already been learned through concrete experience. A child's speech is a verbal accompaniment to behavior, not a determinant of behavior.

Students of Piaget (Inhelder et al. 1966) investigated whether language may also stimulate cognitive growth. They concluded that there are points where this can occur. For example, during the preoperational period, the child learns to detach thought from action. Language, which is inherently symbolic, becomes the medium for representing missing objects and past events. In addition, language may help children focus on relevant dimensions of a task and aid storage and retrieval of data. Piagetians confirm, however, that experience, not language, fundamentally contributes to and forms the integration of new concepts.

On the other hand, Vygotsky contended that language, particularly adult-child dialogue, does stimulate cognitive development. According to Vygotsky, the model provided by adults is critical for teaching names, demonstrating language structures, and providing practice for young children. Through the adult model, children acquire form and structure that are then the organizing sources for the structure of thought.

Bruner's position falls between Piaget's and Vygotsky's. Before language can develop, he wrote, children have lots of opportunities to explore and learn from their environment. Once language acquisiton begins, language itself becomes a major stimulant of cognitive growth. The sophisticated strategies used to acquire language, itself an abstraction, become available for general cognitive learning.

Each theory holds implications for the development of language and thought. From a Piagetian viewpoint, children should be provided with lots of independent activities. Through play, they will structure their environment, assimilate data, and adjust their cognitive structures as novel information demands. Vygotsky's viewpoint suggests the importance of opportunities to hear and interact with adults. Bruner would encourage a variety of direct experiences for children with lots of opportunities to describe those experiences in their own terms. Adults would be encouraged to build on the language used naturally by the child. Bruner's position is probably most widely espoused by early childhood practitioners.

Bruner's view of language development provides practitioners a guide for planning instructional activities. It also permits the work of Piaget and Vygotsky to inform that framework. A good language curriculum should include elements of the work of all three theorists: abundant independent activity, adult-child dialogue, and opportunities for youngsters to describe their experiences and build on language forms (Pflaum 1978).

Written Language Development: Reading and Writing

Connecting Oral and Written Language

As we have already noted, research confirms that most children come to school with a firm grasp of the language spoken in the home, and that they achieve this with minimal formal instruction. Certainly, we have all marveled at the ease with which very young children acquire highly complex language systems. Seemingly, language acquisition requires little more than exposure to the language. Children bring this same language competence with them when they begin to read. Yet the acquisition of reading and writing skills often appears an entirely different task, extremely arduous and unrewarding for many children.

If we examine the context in which first language learning generally occurs, we discover certain factors consistently present. First, children acquire spoken language in warm, rewarding, positive atmospheres. Parents are generally delighted with whatever the child accomplishes, and they show it.

Second, children acquire spoken language in an atmosphere that conveys respect for the uniqueness of each individual. There is little pressure to mold the child to fit a group standard. Individual styles and approaches to the task of language learning are generally respected. The young child is not asked to alter his or her approach to learning in order to conform to a preconceived method. Parents usually judge a child's achievement in terms of what the child is doing today that he or she could not do yesterday.

Third, children acquire spoken language in a child-centered atmosphere. The child is an active participant, curious about the environment, asking questions, and demanding to know. First language learning is largely guided by the child's purpose or intent.

Fourth, children acquire spoken language in a meaningful context. First language learning and concept development are always related to meaningful activities, objects, and situations in the child's environment. If there is no meaning—if the new word or concept does not make sense—it is discarded. Each new idea or element of language must find its place in the child's existing framework of knowledge.

Reading comprehension also involves a search for meaning. Through the medium of print, the reader must construct meaning from the author's message. Indeed, psycholinguists Smith (1971) and Goodman (1970) asserted that similar meaning-constructing processes occur in both reading and first language learning. For example, both involve predictions about what one expects to read or hear. These predictions are based on knowledge of the world and of the language in use. The more we know about a topic and the more we know about language, the better our predictions can be. Thus, what we bring to the text largely determines the meanings we construct. Knowledge of our world and our language affects our understanding of old information and helps us to make connections to information that is new.

Reading involves constant confirmation of predictions by means of a variety of strategies. Graphophonic clues (phonics), semantic clues (word meanings), and syntactic clues (sentence structure) are used simultaneously as the reader presses for meaning. The degree to which these strategies are used is largely determined by the degree to which the text matches what the reader expected to find communicated there.

Understanding the message, then, is the ultimate goal of the listener as well as the reader. As understanding occurs, it results in a steady reduction of uncertainty. Data are confirmed and new information is processed and applied in order to formulate new predictions. Reading comprehension, like language learning, has an element of pragmatism. The reader's intent or purpose influences how the task is approached and how well the reader comprehends.

The psycholinguistic model of reading, described above, characterizes the learner as an active participant in the process of constructing meaning from the printed word. The meaning does not reside in the print. As in language acquisition, the learner is largely in control of the reading process as he or she seeks to make sense of the printed message.

Since it is a search for meaning that motivates children's curiosity about print, it should not be surprising that much recent research in early reading development has focused on the child's emerging concepts about speech and print, often called the child's linguistic awareness. Following is a brief review of important findings in this area.

Linguistic Awareness

No matter how children learn about written language, adults must talk to them about reading and writing. Terms such as *letter, word,* and *sentence* emerge naturally in conversations about print. As adults, we have assumed that children understand what we mean by these terms. Recently, researchers have begun to study what children actually know about these units of language and their labels. The current vogue is to describe such knowledge as *metalinguistic awareness*, that is, one's knowledge about language, one's "ability to detach language from its meaning and to reflect upon or analyze its form" (Ehri 1979). According to Nurss (1980), some of the language features on which current linguistic-awareness research has focused are syntactical awareness, word consciousness, and phoneme segmentation. The research cited below provides additional insights into the role of oral and written language concepts in the beginning reading process.

What do children know about the language they use? Research indicates that preschool children are not conscious of words as separate units in speech, although they certainly have command of the use of words. Although they combine and recombine words naturally in speech, these youngsters cannot identify the individual words comprising meaningful communication. If this seems surprising, consider that adults readily associate "djeet?" with a three-word luncheon invitation. Or, you may remember experiences in second language learning. A colleague of mine recalls her amazement at first seeing "Champs Elysee" in print after hearing her high school teacher speak it. Clearly, the more potent segmentation cues are rhythm and stress, useful for communication but not for word identification. Children communicate well orally without this awareness because the focus is on meaning, not structure.

Although knowledge about language is not conscious in young children (Chomsky 1979), it nevertheless plays an active role in their acquisition of reading. For example, when making reading errors, beginning readers use syntactic and semantic information that conforms to their knowledge of oral language more frequently than they use sound-letter correspondence. In his study of children's oral reading errors or miscues, Goodman (1969) reported that when children made a substitution, it was often incorrect on a graphophonic level but appropriate on a syntactic or semantic level; thus, "the boy has a new puppy" for "the boys have a new puppy," or "the boy has a new kitty" for "the boy has a new puppy."

Clay (1972) analyzed the oral reading errors of beginning readers in New Zealand. She concluded that, from the beginning, children expect the sentences they read to conform to the structure of the language that they already know, and that they actively use this knowledge as they read.

What do children know about the sounds within words? Certainly, parents, teachers, and older siblings assume some knowledge. When children ask how to read or spell a word, adults prod them to sound the word out. Research on the nature of the acoustic signal, however, indicates a startling fact: There are no acoustic boundaries separating phonemes in speech. That is, one cannot separate a word, e.g., *bat*, presented orally, into component phonemes, b-a-t (Lieberman et al. 1974). Our ability to hear three sounds in *bat* probably comes from our superimposing our knowledge of print onto spech. The research implies that until they gain experience with letter sounds, rhyming, and reading, children cannot segment a word into its constituent letters. Observation of children backs this up.

What is the relationship between linguistic awareness and reading achievement? Several studies have shown a high correlation between linguistic awareness and reading achievement. Generally, the measure of linguistic awareness is phonemic analysis, the ability to hear sounds in words. This is based on the presumed importance of the relationship between this skill and the task of sounding out and spelling words. A test of word reading usually serves as the measure of reading achievement. With this measure, linguistic awareness is indeed highly correlated with reading achievement. In fact, it has been shown to be a stronger predictor of reading achievement than general vocabulary knowledge (Francis 1973), IQ (Goldstein 1976), socioeconomic status (Downing 1977), or cognitive development (Holden and MacGinitie 1973). While most studies of linguistic awareness and reading achievement used kindergarten or early primary children, Calfee and Lindamood (1973) found that the high correlation between performance on an auditory blending test and a word-recognition test held from kindergarten through grade 12.

Does developing linguistic awareness facilitate learning to read? The research evidence between linguistic awareness and reading achievement is, as mentioned above, correlational. It is important to note that a correlation does not necessarily imply a causal relationship. The correlations yield three logical possibilities, each with instructional implications. First, linguistic awareness may cause reading achievement. Linguistic awareness would then be a prerequisite skill for reading and instruction in linguistic awareness would be necessary. Second, the converse: Reading achievement may cause linguistic awareness. In this case, linguistic awareness would develop naturally as children learn to read, there would be no point in instruction in linguistic awareness. Third, some other factor may cause the development of both linguistic awareness and reading achievement. In this case, also, there would be no need to train children in linguistic awareness.

Evidence supports the view that linguistic awareness emerges as a consequence of exposure to print. Beginning readers do consistently better than do nonreaders of tests of linguistic awareness, regardless of mental age, and the variance consistently decreases. Francis (1973) noted that terms about language forms are always described with examples from written language, not speech. Moreover, the emergence of linguistic awareness—first letters, then words, then sentences—parallels the sequence of reading instruction. Common sense backs up this position. For example, as children see space separating words, they develop a sense of "wordness."

If linguistic awareness is a consequence of learning to read, does this demand of instructors a laissez-faire attitude? Or will teaching about language facilitate learning to read? After an extensive review of the literature, Ehri (1979) concluded that linguistic awareness is not only a consequence of learning to read but a facilitator of further progress. The relationship is thus interactive. Downing (1980) also suggested that we help children become conscious, as necessary, of the forms of our language to help them gain insight into the relationship between speech and writing.

Some studies have shown empirically that training in linguistic awareness effects reading achievement. Most researchers have used variations of the technique developed by Elkonin (1963), a Russian psychologist. Recognizing the difficulty of phonological analysis, Elkonin devised a system for representing visually the sequence of phonemes in words. Composed of a diagram and discs, the system is a clever, simple way of making visual and concrete the concept that a word is made up of components in a particular sequence (e.g., b-a-t). While Elkonin (1963, 1973) reported success with his method, there is insufficient reported data to evaluate his results. Both Ollila (1974) and Rosner (1974) demonstrated transfer to reading from training in phonemic analysis. Williams (1979) evaluated explicit training on phonemic analysis using an approach similar to Elkonin's—blending, letter-sound correspondence, and decoding. Her carefully structured subskills system, called "The ABD's of Reading," was successful in training learning disabled children to decode.

Linguistic awareness appears to be a natural phenomenon that emerges as the child gains experience with print. While it may be deliberately fostered by adults and may facilitate the teaching of reading, the need for formal instruction in linguistic awareness is highly questionable. Adults should be aware, however, of the numerous informal opportunities available to promote children's concepts about print. They should also recognize the importance of these activities for reading achievement.

Children's Early Writing Development

Many educators would agree with King (1978) that "writing rather than reading is truly the hallmark of a literate society." Yet, a review of the history of research on writing by Graves (1980) reveals writing development to be a neglected field of inquiry. Research in writing accounted for only 1.01 percent of all educational research funding between 1955 and 1972. Little of what was done came from leading researchers, focused on process, or dealt with what writers, not teachers, were doing. Graves (1978) further reported that written composition is seldom practiced in schools or taught to prospective teachers in teacher training institutions; such institutions typically teach only the mechanics of writing. This is even more revealing in light of the results obtained by the National Assessment of Educational Progress which revealed that problems in writing among our nation's students lie in the areas of awkward sentences and incoherent paragraphs, not mechanics.

What does research in the writing development of young children reveal? Studies show that well before they enter school, children learn a great deal about print. Before age five, they scribble and draw letter-like shapes. As with oral language and reading, children expect writing to be meaningful (Harste et al. 1979; Goodman 1976). Even their earliest writing reflects a desire to impart a message—to communicate a thought—in writing, rather than aimlessly list letters and words (Milz 1980). Early writing attempts center on self-expression and the pleasure of production through writing. Children express meaning through writing first to themselves, then to communicate with a reader (Birnbaum 1980).

Studies of children's invented spellings (Read 1975; Chomsky 1976) reveal that just as they develop their own systems of grammar during the first two years of life, children often create their own systems of spelling. Further, as in the acquisition of speech, they construct and revise rules as they invent spellings. Studies by Read (1975) and others show that the system for spelling that children devise—though not conventional or adult—follows discernible rules and is both logical and decodable: e.g., "mi dad cr" (my dad's car); "my kampr" (my camper) (King 1980). Stages of invented spelling begin with the use of the first phoneme to spell a word (b for bike); first and last phoneme ("bk" for bike); first and last phoneme and single vowel ("bik" for bike). In the final stage, children come nearer and nearer the standard form. As they experiment with writing, children develop concepts of left-right directionality, linearity, uniformity of size and shape, appropriate placement, and a growing awareness of the forms of written language (e.g., stories, letters, etc.).

Studies of children who learned to read and write with no direct instruction (early writers) reveal that parents of these children responded with interest and pleasure to their children's questions about writing, and that these children saw parents and siblings writing, thus making them aware of the importance and various functions of writing (Durkin 1966; Read 1975).

DeFord (1980) summarized a review of recent research in writing development by suggesting that key factors in children's writing are a rich, meaningful print environment, varied opportunities for individual exploration, and a willing, supportive audience.

Interrelationships Between Oral and Written Language

Oral and written language greatly influence one another as they develop. One might say that the development of the language arts—listening, speaking, reading, and writing—represents an interdependent network. Readers and listeners bring meaning to the message in order to comprehend it. Writers and speakers project meaning as they attempt to communicate.

Both oral and written language involve the use and interpretation of symbols that represent experience. Development of the ability to decode or transform symbols begins at birth. Whether the communication takes place through print or speech, the same base of experience and vocabulary is drawn upon. The functions of oral and written language are essentially the same, since both serve similar, broad ranges of cognitive and affective needs.

The work of Durrell (1969), Bursak (1971), and Lundsteen (1971) indicated that listening skill has a positive effect on reading achievement. Other studies by Petty (1964), Groff (1968), and Anthony (1971) suggested that spelling, handwriting, reading, listening, and written and oral composition influence one another.

One of the most important studies of children's language, done by Loban (1963), revealed interrelationships among the language arts. Loban drew the following conclusions: Reading, writing, listening, and speaking are all positively related. Children who are low in general oral language ability tend to be low in reading and writing achievement. Children high in language ability tend to be high in literacy skills.

A more recent study conducted by Harste, Burke, and Woodward (1982) was designed to study formally the strategies used by preschool children when presented with three written language tasks. The researchers held as a major assumption that written and oral language growth and development parallel one another. They hypothesized that understanding the growth and development of oral language would prove useful for understanding the growth and development of written language. Another major premise of their work was that in order to understand the cognitive and linguistic processes involved in reading and writing, researchers must take into account the linguistic, situational, and cultural context in which the processing occurs. Among the study's conclusions is the following statement regarding the interrelatedness of language learning:

> . . . we must come to understand that what the child knows about one expression of language can support growth and development in another. This conceptualization presupposes a parallel growth and development among the expressions of language. What the child learns about language from having read a book, for example, becomes available linguistic data for output in another expression of language, like writing. What the child knows about how oral language operates becomes available data for discovery and testing of how written language operates. Each encounter with language develops expectations for the forms in which they may be cast. The process is cyclic. What is learned from one encounter becomes the anticipatory data available for subsequent encounters. It is through their experience as writers that young language users in our sample fine-tuned their reading strategies. (p. 129)

Models for Teaching Language and Literacy

Models for teaching language and literacy range from highly formal, teacher-directed structures to those that are informal and student-centered in approach. Along the models continuum falls a variety of combinations and applications of these two extremes. Controversy over the best model for language instruction has been most evident in the area of reading, the subject of considerable debate between those advocating a subskills approach and those favoring a more holistic or student-centered approach. Discussion of this important controversy not only informs the reader about a significant theoretical and instructional distinction, but it provides a basis for developing a personal theoretical framework for instructional decision making.

Theorists now, and throughout the history of reading instruction in America, resemble the blind man describing the elephant. Looking at reading instruction they describe two different processes with different instructional implications. The first process is generally referred to as the holistic or top-down model; the second, the subskills or bottom-up model. Each model has instructional implications.

Historically, reading curricula have swung between variations of these two approaches. In the early days, a subskills approach emphasized spelling. Then, in the mid-nineteenth century, this method was criticized as mindless and boring and a more holistic approach gained ascendency. The reverse swing of the pendulum is generally attributed to the publication of two books, the titles of which tell the story: Rudolf Flesch's *Why Johnny Can't Read* (1955) and Jeanne Chall's *Learning to Read: The Great Debate* (1967). Both books advocate a code emphasis—Chall's, only for beginning readers. Teacher training institutions and book publishers picked up the gauntlet and phonics instruction became either central or supplemental to almost all reading programs. Now, again, the pendulum is swinging back: Just as the holistic approach was blamed for all educational failure, so now overemphasis on phonics is believed to contribute to lowered reading achievement in the middle and upper grades.

Holistic Model

Smith (1971) and Goodman (1970) are well-known spokesmen for the holistic model. Their work stressed that the goal of reading is *meaning*, not decoding. In the holistic model, reading does not involve translating print into an approximation of oral language. Instead, meaning may be accessed directly from print without recoding print into spoken language.

The meaning gained from a text is not merely a xerographic reproduction or reduction of the text but a message reconstructed by the reader. Meaning does not emanate from the text itself but from the reader who uses his knowledge of the language and the world to generate hypotheses about what the author is saying and reads to confirm or disconfirm those hypotheses. Thus, the reader is not a mere passive recipient of an inviolable message in the text but an active participant in the process of constructing meaning. In this view, reading is, to use Smith's (1979) term, an inside-out process.

The strategies used by the reader to gain meaning involve *predicting* based on prior knowledge and limited textual input, and *sampling* to test one's hypotheses. For example, given the title of a book on corporate America and information that the author is an assistant to Ralph Nader, a skilled reader might predict that the message will be critical of big business and its effect on the average citizen. The efficient reader then samples the text, processing only those words and phrases necessary to construct meaning. Sampling a message is a skill that all language users develop. Just as we get the gist of a friend's conversation even when noise prevents us from hearing every word, so the reader need not attend to every word to gain meaning. Readers use syntactic, semantic, and graphophonic information within the text as clues in the search for meaning. Thus, reading, to use Goodman's (1970) terminology, is a psycholinguistic guessing game.

Instructional implications. The central tenets of the holistic model have direct implications for instruction. Since the model contends that the reader accesses meaning directly from the text without recoding print into speech, the teaching of decoding skills, especially sound-symbol relationships, is not only deemphasized but considered counterproductive to the real reading process: efficient text sampling to gain meaning. Children must recognize that the goal of reading, like the goal of listening, is to construct a message, to establish communication with the unseen message-giver, the author. For this to happen, children must expect reading to make sense.

Since reading requires the simultaneous use of varied skills, instruction does not stress prerequisite skill development. Sequencing of skills instruction would be arbitrary. Instead, a language-experience approach is used. From the outset, children read real-life, meaningful materials: signs, stories, stories they have generated that have been written down by someone else, directions for games, songs, poems, recipes. Instruction stresses using a variety of contextual clues to obtain meaning: e.g., pictures, context (semantic and syntactic), configuration, and initial letters.

The philosophy underlying this method also affects our understanding of the problem reader. Decoding deficiencies are not considered the prime problem. Instead, it is hypothesized that these students have not yet realized that reading is a functional, meaningful activity in their personal or cultural world.

Subskills Model

The subskills or bottom-up model, by contrast with the top-down model, is data-driven or outside-in (Smith 1979). The controlling factor is the textual input. The reader begins with groups of letters recognized as words, phrases, and sentences. Reading skills are seen on a continuum. The mature, fluent reader accesses meaning directly from print but the beginning reader cannot. Reading is thus a developmental skill with prerequisites and subskills.

Automatic processing of print is considered an essential skill to be mastered by all readers (LaBerge and Samuels 1974). Perfetti and Lesgold (1979) stressed the centrality of rapid, automatic decoding in reading comprehension. They argued that if prose processing is not sufficiently automatic, energy is not freed to focus on comprehension. Because of information processing limitations, any decoding deficiency will interfere with comprehension strategies.

Instructional implications. Because in the subskills model the beginning reader does not access meaning directly from the text but first recodes to print, direct instruction in decoding is considered necessary. Phonics are taught as an aid in determining the words and thus the message on the printed page. Readers cannot be introduced to all the words they will encounter. Nor can readers be expected to memorize, at the outset, a wide sight-word vocabulary. The ability to decode through knowledge of phonics gives readers confidence that they can figure out what is on the page even if they have not seen the words before. Confident of this useful strategy, the reader will more willingly try out a variety of printed messages.

The specific instructional sequence usually involves letter/sound correspondences and pattern recognition (e.g., word families). Segmenting words into constituent elements (e.g., man = m-a-n) and blending sounds back together to form a word (e.g., mmm-aaa-nnn = man) are taught as prerequisite skills for phonic instruction.

Finally, in the subskills model decoding deficiencies are considered central to reading problems.

Which Model is Better?

Criticism of the Holistic View

Proponents of the subskills model recognize that many children, especially those coming from high-SES backgrounds with exposure to a rich array of print, language, and experience, do learn to read by a language-experience approach with minimal direct instruction. Informal observation indicates that these children seem to notice patterns on their own, generalize the pattern information they have learned to new words, and practice their emerging skills using a variety of print sources. However, many children do not automatically learn to read. While they profit from programs that stress reading for meaning, they need programs that make patterns in written language explicit. If only a holistic approach is used, these children are cast adrift to grope through print by guesswork (Adams et al. 1980).

The holistic model allows for instruction in patterns only after a need for such instruction emerges. Subskills proponents criticize this wait-and-see approach on two counts. First, the teacher must evaluate and handle each child's deficiencies, thus placing a heavy diagnostic and managerial burden on the teacher. It is more efficient for a teacher to know the general sequence in which skills develop and to teach these skills directly. Second, critics state, the holistic program waits for the child to experience failure and frustration before beginning instruction in prerequisites.

A major criticism of the holistic model is that it is vague in terms of instructional practice. Certainly, the argument that the student must understand the communicative and functional value of language is compelling. Moreover, presenting children with an array of print resources is appealing. However, the teacher needs to know what to do on Monday morning. Implementation of a classroom reading program does not flow from this model. Smith (1979) himself recognized this criticism, admitting that his model did not offer prescriptions for methodology and was not directly translatable into practice.

Criticism of the Subskills Approach

Proponents of the holistic model contend that breaking the natural whole of reading into parts distorts the reading process, eliminates the variety of naturally occurring clues for meaning, and causes the reader to focus on a skill, decoding, that is not the same as real reading. The subskills approach is also criticized for ignoring the child's basic linguistic competence and the language learning capabilities he or she brings to the reading process.

Smith (1979) debunked the traditional rationale for phonics—teaching sound-symbol correspondences to develop independence and relieve memory load. He claims that the system of correspondence in English is complex and unreliable. Moreover, he asserted, there are no known limits to human memory.

In terms of the outcomes of using a subskills approach, critics contend that students in curricula emphasizing phonics become preoccupied with letter and word recognition and lose the meaning of the text. Children become mere word-callers instead of engaging in the process of constructing meaning from text.

And finally, proponents of a holistic model voice concern that students' tendency to focus on decoding might not be a temporary strategy used at a particular stage but may become a habit, obstructing the need to read to gain meaning. Fredericksen (1979) expressed concern that emphasis on decoding may bias children to approach reading as a bottom-up process that differs essentially from the process of comprehending language.

Empirical Data Comparing the Two Approaches

Which method has been scientifically proven better? There are no clear answers to this question. Overall, from the major studies on reading programs, a pattern emerges: When the outcome measure is word recognition, subskills programs measure best on standardized texts, especially for low-SES children and low achievers. When the outcome measure is comprehension, beyond the lowest for first grade level, there are no differences between the models (Resnick 1979).

The Follow Through program evaluation is typical of the results found when beginning reading approaches are compared. Follow Through was an Office of Education national experiment in primary reading education for poor children carried out and evaluated in the late 1960s and early 1970s. The planned variation design allowed for comparison among the achievement of pupils enrolled in a variety of programs and non-Follow Through pupils.

One major finding of the evaluation reflects results common in educational research. Each model had significantly different effects in different communities. These intersite differences were greater than differences between the models (Anderson et al. 1978). That is, the local context of the model—the teacher, the school, the neighborhood, etc.—influenced the students more than did variations between the programs.

The second finding was that the program that was most structured and used a clearly sequenced subskills approach, the University of Oregon's Direct Instructional Model, produced the most gains. These gains were strongest in grades 1 and 2, weaker by grade 3, and nonexistent by grade 4.

Critics of the research state that it is not surprising that children trained in a subskills approach do better on standardized tests, since these tests closely approximate the content of subskills programs. Indeed, these critics claim, any other result would have been difficult to explain.

An Interactive Approach

Eschewing the two extreme philosophic positions presented above, many theorists adopt an interactive approach. They view the reading process as an interaction between the reader—his or her intent, prior knowledge, and knowledge of the code—and the text, with its particular syntactic, semantic, and conceptual load. Thus, reading is neither inside-out nor outside-in, but both. The interactive approach allows for more eclectic instructional procedures, using valuable insights and activities from both the holistic and subskills models.

Learning to read is a highly complex process. No single method or approach, no one set of instructional materials has proven effective for all children. It is this writer's view that comprehension should be stressed throughout reading instruction. Teachers need to know a great deal about all word-recognition techniques so that they may make appropriate decisions about how much to teach and what approach to use with specific children. Phonics should be taught in conjunction with other word-recognition skills, particularly contextual analysis, so that pupils learn early to use these skills in combination with one another and expect reading to make sense just as they have come to expect oral language to have meaning.

Eller (1980) made the following indictment of overemphasis on phonics:

> It is noteworthy that the books and articles that overemphasize claims for the intensive phonics approach to beginning reading make almost no mention of reading comprehension. The indifference of the "phonics-first" school of thought toward "meaning" is illustrated by an anecdote from Flesch's 1955 book on this subject. Flesch, who had taken a one-semester course in the Czech language when he was about 15, acknowledges that he had "forgotten" everything about the language itself, but I still remember how the letters are pronounced." He then reports, "Armed with this knowledge, I once surprised a native of Prague by reading aloud from a Czech newspaper. 'Oh, you know Czech?' he asked. 'No, I don't understand a word of it,' I answered. 'I can only read it.'" Flesch's naive inclusion of this conversation in his own book is typical of the phonics-firsters' lack of concern for comprehension in reading.

The issue, then, is largely one of emphasis. An interactive model makes a case for balance in the reading program.

The Classroom as Context for Language Learning

Language and literacy development is integral to all learning. In the classroom, language is at work as learners explore the physical and social world and as they encounter literature and the arts. As teachers, it is our responsibility to create a classroom environment in which communication is valued and processes of discovery, exploring, and creating through language are allowed to flourish. The nature and quality of the planning and organization for instruction and the communication used to orchestrate instruction combine to play a major role in influencing the language-learing climate of the classroom.

Recent research in language use in educational settings (Cazden 1981; Erickson 1982; Gumperz 1981; Hymes 1981) highlighted the importance of how language, in the form of interaction between teacher and students and among peers, functions in the classroom. The way language is used, whether spoken, written, or expressed through facial expressions and gestures, effects the very climate in which it is being learned. In her review of the research in this area, Green (1982) described the classroom as a differential communication environment. The requirements for participation by teacher and pupils shift constantly. Teachers orchestrate various levels of participation (whole group, small group, and one-to-one), they interact with and evaluate students, and they signal the theoretical framework or model of instruction from which they are operating by their behavior and expressed expectations. Green's research suggested that teachers orchestrate a variety of strategies to achieve a variety of goals in a variety of ways: "Teaching, therefore, is a creative process; it is a process of creating environments, of creating activities, of creating situations with children so that children can master the academic and social content of schooling" (p. 21). Communication is the vehicle for this process.

Green also reported the work of Merritt and Humphrey (1982), who observed that teachers must monitor and orchestrate:

1. a lesson being taught to a particular group; and
2. simultaneously occurring other group- and peer-learning situations;

and that within lessons teachers must:

3. present academic content;
4. structure the activities;
5. distribute turns at talking; and
6. maintain order and flow of activity. (p. 22)

Obviously, the task of instruction goes far beyond the mere planning of a sequence of academic content. Teachers must attend to social as well as academic concerns in instruction. Teacher behaviors and language communication must reflect careful judgments about what is appropriate for each student. Students must not only acquire academic knowledge and cognitive skills, they must communicate that knowledge in appropriate ways and at appropriate times, as defined, largely, by the school. The teacher's knowledge of the patterns of communication established in the home helps mitigate any inconsistencies that may exist between home and school communication.

The teacher's role is critical to establishing a positive communications environment. Research overwhelmingly indicates that, more than any other single factor, the teacher can make a difference in students' progress. How teachers view their roles in the classroom may promote or possibly impede language development in some children.

In a survey conducted by the National Conference on Research in English (Robinson and Burrows 1974), statements of criteria for excellence in teaching were collected from 18 nationally known leaders in the language arts. The investigation was an attempt to discover what makes a good language-arts teacher, and what constitutes good language-arts teaching. The five statements of criteria for excellence in the language arts provide an excellent overview of the qualities of the effective teacher in a positive language-learning environment. The following teacher behaviors were said to exemplify excellence in teaching the language arts:

1. Seeking to understand each learner's background—social, cultural, linguistic—in relation to established sequences of child development.
2. Seeking to unify cognitive and affective learnings through action and reflection.
3. Acting upon knowledge that communication springs from, is supported by, and contributes to social interaction; utilizing children's language to capitalize on interaction.
4. Seeing oneself as guide, listener, questioner, reactor, and, in general, as facilitator of language learning.
5. Building language on experience and experience on language; fostering genuine, purposeful, enjoyable communication among pupils and with others; showing appreciation for pupils' uniqueness and growth in the use of language. (pp. 71-75)

The qualities expressed in these statements should be kept in mind as principles underlying the role of the teacher, the single most influential force in providing a positive context for language learning.

Implications for Instruction and Evaluation

What does the research imply for the instruction and evaluation of language and literacy in the schools?

When we teach and evaluate listening, speaking, reading, and writing, we should:

1. take advantage of children's natural ability to learn language and their need to communicate. This suggests a meaning approach to instruction from the beginning.
2. teach communication processes through content of interest and importance to children. There should be no division between learning language and learning through language. From the earliest stages of instruction, students should expect that what they talk, read, and write about will make sense and have relevance to their lives.
3. provide time in school for students to use and develop what they know about language and literacy in a functional, social context.
4. provide instruction that takes advantage of the interrelatedness of language processes while providing a focus on each process.
5. assess language competence in terms of the *process* by which the learner puts it to use. A process model of evaluation is concerned with what and how the child attempts to communicate.
6. view the teaching/learning process as the ideal time for observing the learner's progress. The best evaluation procedures are an integral, ongoing part of instruction.
7. evaluate progress in the language learner in the following ways:
    (a) a growing ability to use language in a variety of ways with confidence.
    (b) an ability to use language in a manner that reveals logical and creative thinking.
    (c) an ability to use language for the purpose of sharing personal perspectives.
    (d) an ability to use language effectively in a variety of different situations, adjusting its use accordingly.
    (e) an ability to use language effectively with a variety of others, peers and adults, adjusting its use appropriately.
    (f) an ability to use language as a resource for establishing and improving interpersonal relations.
    (g) an ability to use language to assimilate, extend, and apply new knowledge, attitudes, and experiences.
    (h) an ability to use language in ways that reveal understanding and appreciation of its power and the learner's increasing ability to communicate.

Concluding Statement

Language learning is complex and mysterious—because of the many diverse factors that affect its development; mysterious because of the many unanswered questions about its nature. Even so, the efforts of countless researchers have provided sufficient knowledge to prompt some recommendations about how adults may nurture the language and literacy development of children. This paper has attempted to bring together a body of essential knowledge about language and literacy development with implications for instruction and evaluation. It is hoped that this will be especially useful for beginning educators as a sound basis for decision making on behalf of the children they teach.

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A Resource-Allocation Theory of Classroom Management

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Problems in Classroom Managment

In the hard world of daily teaching, no problem consumes the inexperienced more than the management of instruction. Beginning teachers have said, for as long as anyone has recorded their observations, that they are unprepared to "handle" pupils (McDonald and Elias 1981). Teacher after teacher recalls of his or her early days in the classroom misjudgment of students' capacities, misunderstanding or misperception of students' attitudes, unrealistic expectations for student achievement, ignorance about how to anticipate or control disruptive behavior, and regular subversion of intentions for instruction.

Teachers feel that somehow all of these problems could have been eliminated had they received instruction in practice instead of theory. Their professors counter that they do discuss students' attitudes and values and describe the research on teachers' expectations; both before and during student teaching, they say, the problem of how to manage classes is discussed at length.

In this paper, I will offer a fresh approach to classroom management, which, I believe, both responds to the present body of knowledge regarding this difficult subject and extends to beginning teachers a practical, flexible, and elegantly simple method of maintaining classroom control. But first, let us review the shortcomings of some previous management theories.

Theories that propose variables believed critical to effective management abound. One theory holds that teachers are ineffective because they have "unrealistic" expectations. Another insists that teachers fail because they do not understand students' attitudes and values, particularly when the students come from ethnic or racial groups different from the teachers'.

The error in these theories is that each proposes a single variable to account for all the variance in instructional skill among teachers. If, for example, we believe that teachers' unrealistic expectations of student performance are the cause of difficulties, we imply that modification of this variable will produce radical improvement in a teacher's management skills. Unfortunately, such single-variable theories have a long history of inadequacy.

Some theorists have approached the problem of classroom management in a straightforward, pragmatic way. They have collected information about successful practices and organized the data into lists of recommended practices. This approach is a useful way to begin, but the methodology used is likely to lead to error. If, for example, we ask teachers what practices work for them, we obtain what they think has worked for them. The accuracy of this judgment is only as good as the teachers' observation and analysis of their own practice. Although we are reassured when a significant number of teachers recommends the same practices, these recommendations might be only accepted folklore.

Practical experience is an amalgam of effective practices and folklore. But many rules of procedure communicated by experienced teachers to inexperienced teachers are no more than local cultural rules. "It works for me" is an unobserved criterion measure; no one knows if the rule has been used consistently, or has had systematic effect, or whether there are other practices the teacher uses but does not observe that produce the desired effect.

The Need for Empirical Verification

We spend much time debating classroom management speculatively when we could study it empirically. Resolving such issues as at what point control becomes deleterious depends upon empirical examination.

The value of an empirical approach is well-illustrated by the evaluation of open versus traditional education (Bennett 1976). Traditional education is characterized by formal controls on pupil behavior; open education by less direct control. In traditional education, control is maintained by the teacher; in open education, control is maintained by involving the pupil in an absorbing task of personal interest and worth.

Bennett found that anxiety about learning was affected by the method of control, but that each method produced anxiety that was negatively correlated with achievement. Soar (1977) also found an inverted U-shaped curve for the relation between achievement and methods of classroom management.

This research has yielded two principles: (1) a particular managerial style need not have a single effect; it may have different effects, depending upon its relative strength; and (2) the effect of a managerial style interacts with characteristics of the individual exposed to the style, so that a

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particular style may have more or less extreme effects if the individual is more or less responsive to the style.

Two items in the above discussion are particularly noteworthy. First, both Bennett and Soar had a systematic sample of classroom-teacher performance data, which they related to pupil learning. They analyzed practices to determine which were correlated with certain criteria. They did systematically what is done informally when a professor or an experienced teacher collects information from teachers about what they believe to be a practice that has significant managerial and learning effects.

It is worth noting that the researchers did not set out to investigate management strategies or techniques alone. They were concerned about the larger problems of teaching effectiveness and looked for those practices that correlated most highly with pupil learning. They found some useful principles about management, but of greater importance was that their data showed the interdependence of managerial and instructional strategies.

Three facts in the research on teaching effectiveness are important to note:

1. Management behaviors account for a small portion of the variance in pupil learning.
2. These behaviors are always correlated with other behaviors; they are components in a causal network, not primary causes.
3. The least effective teachers do the most managing.

What do the most effective teachers do? They spend most of their time *instructing*. Management for them is almost exclusively routine administrative chores inherent in the mechanics of instructing; they discipline rarely. Thus, research on teaching effectiveness has shown that management plays but a subsidiary role in effective teaching.

The Direct Instruction Model

Many teachers turn to research on teaching effectiveness expecting to find answers to the question, "How shall I manage my class?" Recent research has produced many theories on this subject, most of which have been formalized into what has been called the Direct Instruction Model of teaching.

There are difficulties with the Direct Instruction Model. The first of these is that it conceives of teaching as a process in which behaviors are either added to or subtracted from the set of behaviors that is a teacher's "teaching-response repertoire." The assumption is that if the set includes the right units, desired effects will occur. Behaviors such as "structuring" or "monitoring," if added to the set, will produce more effective management—or so we are told.

The problem with this assumption is that the teaching behaviors described as necessary are not discreet. The correlation matrices produced in these studies reveal considerable multicollinearity, which one ignores only at the risk of misinterpreting the data. A behavioral response such as structuring is usually correlated with one or more other behavior sets. The correlation between structuring and an outcome measure is one correlation in a network of correlations, which includes the correlation between other teaching behaviors and the outcome and between these other behaviors and structuring. Only if this network is analyzed by studying the partial correlations among the various behavioral components is it possible to estimate the relative dependence of one variable on another.

The practical consequence of underanalyzing and therefore underinterpreting data is that one repeats the inferential error made in commonsense interpretations of teaching effectiveness in which one behavior is isolated as the principal cause of desirable managerial effects.

Even if these variables, the behavioral components in the Direct Instruction Model, were empirically independent, they have still been assembled in the model by a process of metaphorical analysis. The researchers studied the collection of teaching behaviors that are significantly correlated with outcome measures. This collection *suggests* a model; that is, it suggests a picture of didactic instruction under the continuous control of the teacher. Didactic instruction follows a simple algorithm: explain, practice, evaluate. The significant correlations are then combined in the paradigm by allocating them to these components of didactic instruction. The question is, have the researchers imposed their preferred model of instruction on the data?

What is important to recognize about this metaphor is that it is not a description of teachers who actually apply the model in a consistent, routine way and whose teaching has been demonstrated to be highly effective. Such evidence as has been produced for the effectiveness of direct instruction has been largely anecdotal and metaphorical.

I believe the Direct Instruction Model to be a useful but crude reflection of the data. Unfortunately, the model seems to have been cast in iron and is treated, as are many of the metaphors used over the decades to prescribe management practices, like gospel.

Toward a New View of Classroom Management

I offer an alternative explanation for the research data. I do this because certain information in previous studies has been ignored, resulting in a fundamental conceptual error.

The way to address the problem of management is *analytically*, by constructing multiple regression equations and estimating how well the outcome measures, such as achievement scores, can be predicted by using a linear equation that combines additively components such as prior learning, teaching behaviors, and pupils' background and aptitude characteristics. When this is done, multiple-"R's", the measure of how useful the equation is as a predictor of outcome, are far more substantial than individual correlations of teacher behaviors with outcome measures. In one analysis of reading and mathematic scores on two grade levels, these multiple-R's ranged from .39 to .96 for three different forms of outcome scores. (McDonald and Elias 1976).

When pupils' prior learning is used as part of the design, one finds that prior learning, measured by an achievement test of some kind, accounts for a substantial portion of the variance in the final scores (that is, the scores gathered after teaching has occurred). The results of the pretest may account for 64% to 81% of the variance in the post-test scores, which means that pretest correlations with post-test scores were on the order of .80 to .90. Therefore, the remaining variance to be accounted for by teaching behaviors or pupil characteristics is relatively small, somewhere between 10% and 20%. A set of variables that accounts for 10% of the remaining variance is accounting for a very small portion of the change in pupil behavior. But when this set of variables accounts for most of the remaining variance, it is, indeed, a variable to consider seriously.

The equations that produce a significant multiple-R in research analyses also tell us the significance of each of the components of the multiple-R. We look for those components in the equation that have significant regression coefficients. These are the best predictors of outcome effects. One or more components may be significant; they may be either positive or negative contributors to the prediction. Further, the equation gives the proper combination and weighting of these variables.

One need not invent metaphors that combine zero-order correlations treated as if teaching performances were uncorrelated. The linear (or a higher-order) regression equation substitutes a quantitative description for a metaphor constructed by selecting among variables. Furthermore, the multiple regression equation has taken into account the intercorrelation of all the variables in the original data set.

From such analyses it is evident that *combinations of variables* describing teaching make the best predictions of pupil learning. If only single variables were powerful predictors, either the regression equations would not produce significant multiple-R's or, if they did, one variable would have a significant regression coefficient and the others would not. But multiple regression analyses that produced significant multiple-R's contained more than one significant teaching variable. Combinations of teaching behaviors are mediators of instructional effectiveness. We then ask, is there an interpretable pattern in these combinations? Do more and less effective teachers have contrasting patterns? Where are managerial behaviors in these patterns? How might we explain the effects of these structures on learning?

What I propose in the next section is a theory of classroom management that uses the fact that combinations of teaching behaviors mediate instructional effectiveness and that offers a description of causal mechanisms that accounts for that mediation.

The Structure of Teaching Behavior

As a preliminary to presenting my theory of classroom management, it would be useful to note and emphasize features of teaching behavior that are invariant and must be taken into account in any explanation of how teaching produces learning. There are three such characteristics: (1) teaching behavior is time-bound; (2) teaching behavior is linear and sequential; and (3) teaching behaviors are interdependent, so that an increase in one behavior involves a decrease in another.

The third characteristic suggests that the distribution or proportion of behaviors with respect to each other is likely to be the most significant feature of teaching behavior. Obviously, for example, if a teacher never did anything but evaluate, instruction would not occur in the classroom. (There are instances of such teaching. I have seen mathematics classes taught by assigning homework, without prior instruction, which is corrected the next day.) Also, criticisms of teaching almost invariably focus on the relative lack of some kind of teaching behavior—not enough explanation, not enough higher-order questions, not enough corrective feedback. So we intuitively know that it is these proportions, the balance between the components of instructional activity, that probably make the difference in the relative effectiveness of teachers.

In one study (McDonald and Davis 1978), a new inservice program was the vehicle for teaching about effective reading instruction. The instruction was organized in modules to be evaluated by their effect on classroom performance and on pupil learning. The modules described reading activities teachers were to apply in their classrooms. We observed this application and measured the effects of the activities on pupil learning using a pretest/post-test design.

One of the modules was an assessment module in which teachers learned to measure reading performance more effectively. Surprisingly, teachers who used this knowledge more extensively had lower pupil performance scores on reading tests. The reason for this negative correlation was that the teachers used assessment time at the expense of instructional time. In some cases, techers devoted most of the two weeks' post-instruction time to giving tests, which meant that pupils received little instruction during that time. (Some will say that assessment provides, through feedback, a form of instruction, and while that might sometimes be true, there was little feedback in this case.) Despite folklore to the contrary, each teacher does a limited number of things simultaneously; usually, the activities may be mediated through different sensory modes. A teacher shifts attention rapidly from one task to another. (Some teachers apparently cannot shift easily and may avoid situations, such as grouping, that require them to do so.)

In the study referred to earlier (McDonald and Davis 1978), we studied pupils' attending behavior in relation to their physical location with respect to the teacher. In the school in the study, teachers characteristically worked with one group while one or two other groups were more or less close to the teacher's physical location. Pupils' attending behavior decreased directly in proportion to their distance from the teacher. There were, however, large individual differences among teachers in these rates; one teacher might have 50% of the students on the periphery off task, while another teacher might have only 20% off task in the same location. (Interestingly, these percentages were not affected by the presence or absence of a teacher's aide in the groups away from the teacher.) Much of this off-task behavior went unnoticed. Lack of attention to off-task behavior is probably not due to lack of awareness that pupils need to be monitored. Rather, teachers may not have the requisite information-processing skills for managing a completely structured instructional system.

A teacher is exposed, simultaneously and continuously, to 30 or more different sets of information about his or her pupils. More effective teachers manage this information by organizing it efficiently or by organizing classroom activity so that the information comes to them in a sequential fashion that they can process more efficiently.

The teacher *allocates* his or her attention, interaction time with pupils, and the cognitive resources he or she brings to each learning task—i.e., knowledge and the skills to convey knowledge. The teacher allots both time and skill to conducting various instructional activities. How teachers make these allotments determines how teaching behavior is structured in a particular classroom, and we already know that it is the structure of teaching behavior that determines its effectiveness.

Consider the teachers in this study who took their inservice training so seriously that they spent the better portion of two weeks assessing pupils' reading performance, with the consequence that their pupils had lower reading scores. These teachers had allotted almost all the instructional time to giving reading tests. A test may take 15 minutes; however, it takes about five minutes to distribute the test, another five minutes to give instructions for it, and five minutes to collect the test. Thus, 30 minutes may elapse in the process of giving one 15-minute test. In a one-hour period, only 15 minutes would remain for instruction because 15 minutes would likely be assigned to finishing off the period, giving assignments, directions, and other administrative matters. If the teacher now gives a second test, or if the first test runs longer, the entire instructional time would be devoted to collecting information. In general, research has shown that where the alternatives are on-task behavior or off-task behavior, more on-task behavior is correlated with more learning. How differences in time allotted to different kinds of tasks affect learning was explored in Phase II of the Beginning Teacher Evaluation Study (BTES) (McDonald and Elias 1976). This observation system categorized pupils according to whether they were working with the teacher individually or in a small group or large group and whether pupils working alone at their desks (seatwork) were supervised or unsupervised. Unsupervised seatwork was always negatively correlated with pupil learning. Pupils were assigned to this instructional mode in some classes for 30 to 45 minutes. It made little difference whether the pupil was on-task or off-task during this period, although children who could not master the task without the help of the teacher often went off task.

Pupils may be involved in tasks of differing complexity, difficulty, or abstraction. In a reading lesson, for example, pupils work on literal comprehension of a story: They identify the facts of the story; the teacher questions them about these facts and corrects their responses. The reading lesson may include other kinds of activities—episodic analysis, exploration of the author's intent—thereby increasing the lesson's complexity and abstraction. The pupil is required to categorize, schematize, identify relationships, and engage in other higher-order, cognitive processing tasks.

Typically, two kinds of processing go on during instruction: (1) processing by the teacher, and (2) processing by the students. Each is processing different kinds of information as well as common information. They may be doing different kinds of processing at the same time and in different sequences.

The interactions between these kinds of processing may be unclear. When a question is not answered correctly, the teacher makes an allocation decision, either to allot time for correcting the answer or to move on to someone who knows the correct answer. Moving on keeps the original information-processing system functioning; the teacher does not digress into a sub-routine to correct an error. He or she balances the learning to be achieved by correcting one pupil against the time lost on that sub-routine.

As the above examples make clear, I am using two concepts to interpret what goes on in classroom interactions. One concept considers instructional activities as information-processing tasks. The other concept is that of resource allocation. The teacher is viewed as an information processor allocating function-processing time to the information-processing systems of pupils.

A Resource Allocation Theory of Classroom Management

The kinds of instructional activities in which teachers engage may be described by an allocation function. The teacher allots time across and within information-processing tasks. This allotment determines how much and what kind of information processing pupils engage in.

Let us begin with a fairly simple analysis of these activities. In the initial allocation decision, the teacher chooses to produce new learning or to maintain old learning (acquisition or maintenance). If the teacher moves into an acquisition phase, he or she may choose one of several strategies to facilitate learning. The teacher may demonstrate what is to be learned or may elicit it progressively. Such components are typically followed by an evaluation component in which progress is evaluated.

Another alternative is for the teacher to move into a maintenance mode in which he or she reinforces what has been previously learned. This may be done by rehearsal of what has been learned or by conducting an evaluation.

I include several smaller activities within these larger activity categories: *Demonstration* may include a lecture, an explanation, a formal demonstration as in science classes, or modeling behavior. *Elicitation* may include questioning, having pupils write essays, making reports, working problems, or other activities in which students must construct some form of the desired response. *Evaluation* may occur through simple questioning, or through technical assessment. *Signalling*, referring to an activity in which the teacher tells the pupils what they are to do, may be performed in a chunk at the beginning of the school day or at scattered times as tasks change. The teacher will also return to signalling whenever he or she sees a need to give more specific instructions.

What is Management?

What is management within this conceptual scheme? Signalling activities are clearly managerial because they are preparatory to instruction. Each instructional task requires specific resource allocations: the amount of pupil-time assigned to each task; the amount of teacher-time allocated to the task; the amount of teacher-time allocated to each pupil during the task; the time allocated to each level of complexity of the task; the time required for distributing materials; the time required for manipulation of these materials; the time required to organize for successive tasks. Variations in these time distributions affect the pattern of instruction. Some distributions increase total instructional time; some modify the instructional time allotted to different information-processing tasks; others are straightforward management tasks.

Complex tasks require more processing time, both on the part of the teacher to convey the necessary instruction and on the part of the pupils to learn to use the instruction. Instructional time is not reduced but differently allotted. A teacher who spends more time on inferential comprehension in reading engages pupils in a more difficult processing task and undertakes a more difficult teaching task. The task will take longer, but the pay-off will be considerably greater. We once observed a teacher whose class had perfect on-task behavior during a three-month span (we observed the class at least one-half-hour a day, four days a week). However, only three comprehension questions were asked during our observation from October to December. With that time allocation, pupils could improve only the simplest reading skills.

Some might use this example to criticize the notion of on-task behavior. But the problem is not that pupils are on-task, nor should the implication be drawn that on-task behavior is best when the task is low-order. Resource allocation is what should be attended to. We now have to modify this teacher's allocation of resources if other learning objectives are to be attained.

An instructional period may be analyzed to find how much "real" time is used for each kind of information processing. For example, how much time is given to inference making and testing? To categorizing and schematizing? To recalling items in a list? To generating inquiry questions?

These questions illustrate the differences between the resource-allocation theory of classroom management and other management theories. From the perspective of the resource-allocation theory, we do not ask how many higher-order questions a teacher asks, but how much time is allotted to the processing activities that those questions should stimulate. The proportion of time allotments appears in the answers to such questions.

Did we not get the same result when we found that the teacher asked only three higher-order questions in three months? Perhaps; but the teacher may have included other ways of generating these higher-order functions.

Resource allocations may be viewed as investments with certain payoffs. Some form of investment must be made because the teacher is always allocating information-processing resources in real time. The problem in designing instruction is to make the right amount and kind of investment to achieve payoffs.

Research clearly indicates that the ratio of instructional time to managerial time is the critical variable related to pupil learning. If, for example, significant amounts of time are devoted to signalling activities, instructional time decreases and learning declines. Also, if a significant amount of managerial time is imbedded within instructional tasks, learning will be less.

What, then, is management? *Management is the allotment of instructional resources, measured by the time required to allot, in such a way that progress towards learning objectives is maintained.* The most effective managers are those who use the least amount of time to maintain a steady flow of resources. Problems in management result either from poor timing of the arrival of required resources or from providing the wrong resources. For example, off-task behavior may signal (1) that the child is finished and needs a new task, or (2) is having difficulty with the task, or (3) is distracted. The teacher must (1) provide explanation, directions, and perhaps materials for the new task, (2) attend to the difficulty, and (3) recall the child to the task.

It is important to see these actions as allocations, not simply as behavioral responses. The teacher may choose to ignore the situation or do something about it. Doing one thing means the teacher does not do something else.

Information-Processing Resources Needed by Pupils

Pupils need specific information-processing resources made readily available to them. They need directions, a clear explanation of the steps they must carry out during instruction; they need to know what kinds of processing are to be used in each task; they need time to try different kinds of information processing; they need feedback from the teacher during these processing trials; finally, for some tasks they need materials. Two kinds of resources are allotted through managerial activity: directions and distribution of materials. Other resources are allotted by means of instructional activities. Obviously, a teacher can carry out more instruction if the time for the two clearly managerial functions is held to a minimum. As researchers have noted, much time is lost in activities such as distributing materials, moving from one activity to another, collecting papers, and giving directions.

Most practitioners and researchers treat management as a process of applying skills. When certain stimuli occur (indicating, for example, that a child is off task), one is taught to respond by calling on, reminding, or standing near the child. Those who hold this view train people in specific techniques of management that are assumed to reduce interruptions dramatically.

On the contrary, I argue that what is to be maintained is processing time. The child's thinking is to be sustained; if he or she is practicing a skill, then sustaining that practice is the goal. When a teacher knows how to sustain processing, management problems disappear.

The relation between attention and performance is interactive. To begin a task, one needs to attend to entry behaviors. But as one moves into the core behaviors of the task, attention increases because it is impossible not to attend and still do the core behaviors.

A child working on a mathematics problem goes through a set of mental operations. He must know what operations to perform to get started. Once he gets started, he will remain on task until he meets a difficulty or is distracted. A teacher creates management problems by failing to give the child instruction about what operations to carry out, or by neglecting to provide for smooth transition into core activities, or by ignoring or overlooking difficulties as they arise.

Effective teachers manage entry and transition well. (This statement is based on observations of particular teachers; researchers have not categorized these events in their observational systems.) Effective teachers also watch for difficulties and interact with children to provide additional instruction as needed.

A teacher using the resource-allocation theory begins by considering the nature of the processing involved in the lesson to be undertaken, allocating for the processing time required, and balancing this allotment against pupil payoff. If the teacher wants to achieve higher-order objectives, he or she must allot proportionately more instructional time to activities requiring higher-order cognitive processes. For each task, the teacher allocates time to preparing for, entering, and engaging in the task.

Errors in judgment in time allocation inevitably create difficulties. It takes time to work a difficult mathematics problem, or to read and understand a story, or to answer a question requiring explanation or analysis. Reduce this time, and the task is not complete or is completed poorly. Each achievement, whatever its quality, affects successive tasks. Truncated explanations may get children to the task, but more time will be required to get them into it and engaged. It seems obvious that allocating resources in real time is a congenial idea. But the value of information-processing analysis of learning tasks may not seem so obvious. Information-processing analysis focuses our attention on the processes that must occur if learning is to result. The time required for those processes is the critical variable.

It has always frustrated researchers not to be able to demonstrate that higher-order questions correlate with learning. I see two reasons for the lack of correlation: (1) the structure of the questions is ignored, or (2) the time allotted to the activity is not measured (instead, the variable used is the number of a particular kind of question).

It seems obvious that it is the question and time allowed to answer it, including prompts or requests for elaboration, that show how much time has been allocated to the processing event that must occur if higher-order learning is to take place. If 10 questions consume 10 or fewer minutes, then higher-order processing has been allotted one-sixth of an hour at best, and that assumes that the "real" event, what goes on in the mind of the pupil, occurs for 10 minutes. In one day, a child might spend altogether one hour in higher-order cognitive activity, or, cumulatively, one day per week, or about one month per year. And these estimates are generous.

In summary, counting kinds of questions or numbers of pupils off task may be a useful way to spot problems. But the *nature* of a problem is revealed by *how much time* is allocated to activities.

What Is Effective Management?

Effective management involves optimizing instructional time in relation to the significance of expected pupil-achievement payoffs. The consequences of optimizing instructional time is an instructional strategy that engages students and sustains their attention longer. An observer would note more on-task behavior, but it is not the on-task behavior that produces the learning. Rather, processing time has been deliberately defined—neither too much nor too little—and affected in proportion to the importance of the learning. As a result, learning is easier, difficulties fewer, and engagement more likely and more rewarding.

If teachers view management as resource allotment, they may have more realistic expectations about what can be learned within a given period. Another benefit is that teachers may stop confounding different types of activities that interfere with maximum efficiency in processing. It is well-known that the human mind can do only a limited number of things at a time, but many teaching activities require doing several things at once. A reading lesson, for example, distributes time across several kinds of processing activities: decoding and comprehension of several different kinds, vocabulary acquisition, and information retrieval. In reading a story, a child may be asked what he already knows about the subject and the words. Then there may be an exercise in which new words are attacked, after which some reading is done and literal comprehension questions asked. If time allows, the teacher asks more comprehension questions. This processing structure confounds several different kinds of activity and probably does not allot sufficient time to any one of them. The child gets five minutes of vocabulary, 10 minutes of decoding, 10 minutes of literal comprehension, and so on. The teacher assumes that these units are cumulative, so that by the end of the year the child will have had *x* minutes of vocabulary development. Unfortunately, such an assumption is not consonant with how human information processing occurs.

Proper organization of tasks results from thinking about the kinds of processing required in order to achieve certain kinds of learning. The instructional design engages the child in different tasks that successively require different kinds of processing. The design is optimal when sufficient processing time is allocated, interference of one processing activity with another eliminated, and the loss of time involved in shifting from one activity to another reduced to a minimum. Good design means the amount of instructional time per type of processing activity is maximized; over a school year, that time will be substantial.

In general, that is how effective teachers teach. They begin instruction on the first day and sustain it over time. They allot small amounts of time to management and have few if any discipline problems. They anticipate difficulties. They mobilize resources to instruct, not manage.

In our studies during Phase II of BTES, we found one variable positively associated with learning in every analysis. The variable was a mild form of social control in which a teacher would return a child to a task with a minimum of attention to the child's distractive or even disruptive behavior. The teacher always focused on the task to be done, and, without lecturing, remonstrating, or verbally punishing the child, simply restored the child's attention to the task at hand. In each instance, the action was very brief and infrequent. This form of discipline was typical of the most effective teachers, and in the classes of those teachers, instructional time was consistently high. The critical variable was not the technique but rather the emphasis on instructional activity. The sustaining instructional system was the controlling system.

Years ago at Stanford we sent interns to observe teachers who were more and less effective in managing classes. Upon their return, the interns reported that they could not tell what the most effective managers did because the classrooms seemed to run themselves. One reason for such smooth classroom function was that teachers had established the instructional routine in the beginning of the school year by focusing on it so that pupils became habituated to the routine. After that, the pupils themselves effectively managed the class by their consistent attention to the instructional routine. Similar observations from the first day of the school year have been made of teachers' management practices. Some teachers begin to manage effectively from Day One; others still are not managing effectively six months later and spend disproportionate amounts of time attempting to "control" their classes.

I propose that focusing the teacher's attention on designing and conducting instruction in terms of resources to be allocated to processing activities ensures that the teacher will be an effective manager of instruction. Management is the product of instructional design and the systematic and consistent carrying out of that design. The design itself must be viewed as an allocation of different kinds of instructional time, and these allocations must be made to optimize pupil-achievement payoffs.

This view is both more complex and more simple than other models of classroom management: more complex, because it takes into account different kinds of instructional time; more simple, because it focuses the teacher on the sufficient cause of managerial effectiveness and does not lead teachers to believe that focusing on managerial activity in itself will produce successful management.

Another way of stating the major premises of this theory is that pupil learning depends directly on the availability of different resources, the most important of which is instructional time and the processing time required to benefit from that instructional time. In this view, instructional time is the optimal processing time required to achieve a learning objective.

The fact that we cannot be precise, and may never be, about the amounts of time to allot is not critical. Time boundaries for processing tasks vary with the capacities of the children being taught and with the stages of cognitive development at which those children are functioning. Children who are functioning at the concrete-operational level need the most instructional and processing time. As they acquire more advanced cognitive operations, the amount of instructional and processing time required decreases. Research must determine the boundaries of time required in order to provide sufficient processing time for achieving certain levels of pupil performance. It may turn out that, for practical purposes, one needs only to identify what is too little time. Teachers are already reasonably sensitive to when a task exceeds the abilities of pupils.

Propositions and Hypotheses in This Theory

I present now a series of propositions related to the resource-allocation theory. Some of the propositions are supported by the existing data or are consistent with it; others are hypotheses consistent with the resource-allocation point of view and need more systematic testing.

1. Task involvement increases directly with instructional time and decreases with time diverted to management.

2. Effective instructional time is a function of allotted processing time.
3. Required processing time depends on the cognitive capacities of the child. If a child cannot efficiently perform a specific cognitive function, more processing time is required.
4. If the task structure requires a child to use different functions for short periods of time and intermingle them, more processing time is required.
5. Time required for processing activities decreases as students learn to use processing functions independently.
6. Amount of processing time required decreases as a function of the type of teacher instructional behavior. It decreases exponentially as a function of teacher modeling; minimal teacher explanations will increase the amount of time required.

Embedded in these propositions is the notion of processing time, a key concept of which calls for elaboration. When a teacher asks a question, a set of cognitive activities is activated in the child's head. The nature of the question presupposes the child's ability to perform certain cognitive operations. The child needs sufficient time to perform each operation. Errors in allocating instructional time result from misjudging processing time needed or failure to use instructional behavior that will facilitate it.

Proposition six, above, states that one way to decrease the amount of processing time needed is to increase the amount of time the teacher spends modeling the desired process. This is a straightforward application of social learning theory: The clarity of the explication of operations to be performed determines how much processing time will be required to learn or complete a task.

The other propositions follow directly from the first proposition. Instructional time is time allocated to information processing, and the allocation is based on the time required to perform processing. This is functionally productive time. Organizing time is productive to the degree that it facilitates productive time. As the child develops cognitively instructional time, then less processing activity is required during formal instruction.

What about children's interests, motivation, and attitudes? These factors are taken into account in the propositions. When a teacher thinks about the processing time required for an activity, he or she will consider whether the task is likely to be interesting. For example, teaching vocabulary may be conducted as a rehearsal activity, with the children going over and over a list of words. The processing demands are minimal, but they are also boring. Many teachers recognize this obvious fact and organize the processing (learning) differently. We also assume that, as children learn, their interest increases.

Teachers who focus on providing instructional time are more likely to keep activities moving. Observation of the most effective teachers showed them to be active. There was no wasted time or motion in their class; no time for distraction. Children moved smoothly from one activity to another and were actively engaged during instruction. Most significantly, the pupils learned more than they would have had the teachers spent considerable time motivating and managing them.

How To Prepare the Beginning Teacher

The beginning teacher is not likely to wish for another theory of classroom management. However, resource-allocation theory provides direct guidelines for preparing for and conducting instruction that bear significance for the beginning teacher. These guidelines are:

1. In planning instruction, focus on the character of the instructional activity and the kinds of information processing required of students by the activity.
2. Allocate time to these instructional activities in proportion to the amount of processing time required by them.
3. Decide what resources must be allocated to facilitate processing—what materials must be on hand, what directions must be given, what facilitative activities the teacher must engage in, and how available the teacher must be to pupils during the task and for what purposes.
4. At what level are pupils likely to be able to process the substance of the instructional task? If this level is below the desired level, what kinds of demonstrations or modeling can the teacher do to teach children the operations required?
5. Decide how much time will be devoted to correcting errors, supplying information, etc.—all of which are subroutines that take time away from the main instructional activity.

In summary, I am convinced that management of time is the critical problem for beginning teachers. When they learn how to manage instructional time, they become more effective and managerial problems disappear. A beginning teacher took 25 minutes to take roll in a high school; he had lost the class 23 minutes before the end of the task. The teacher who passes out material for 15 minutes creates a management problem even with small children. Premature pupils have not learned what they were supposed to learn.

Conclusion

Resource-allocation theory is a way of looking at time in terms of the operations a child must perform in order to learn. Most of these operations are cognitive, and instructional time ought to be built around the facilitating of cognitive operations. Sufficient instructional time must be provided to perform them. When time is insufficient, the learning difficulties encountered by pupils contribute to management problems.

Resource allocation accounts more fully for the data on teaching effectiveness than do other management theories it simplifies explanations of effective teaching and gives them structure. Moreover, it avoids giving teachers lists of behavior items to perform as if there were such things as independent activities in the classroom. In these respects, the resource-allocation theory is truer to the nature of teaching than are other viewpoints.

Certainly, I do not propose that resource allocation explains everything or accounts for everything. Rather, I argue that management by resource allocation focuses teachers' attention on the critical variables in instruction; namely, how much and what kind of time and other resources to devote to each instructional activity.

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An Accountability Model for Teacher Education

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When you invest in stock, you keep your eye on it. You want to know if its value goes up or down. At the end of the year, you want an accounting. Did the stock do as well as the broker predicted? And so it is with taxpayers and government funding agencies. They want an accounting for their investment in schools. Are students making the progress predicted by educators?

With public conscience spurred by the civil rights movement of the 1960s and 1970s, the American public invested massive amounts of money to improve the education of educationally deprived children. The avenue chosen for improving education was the public school rather than the college of teacher preparation. The primary reason for this during the 1970s was that few new teachers were being hired. Fewer children were entering school and tenured teachers were staying in their jobs longer.

An estimated $2,000 per teacher per year was spent on inservice training during the 1970s. These funds were allocated to staff development programs such as Teacher Corps, Head Start, Follow Through, migrant education, bilingual education, and special education, and to local school districts with exemplary programs. All of these programs had high hopes and predicted that children who participated in them would thrive. The staff development programs ranged from theoretically-based intensive training, such as that provided by some of the Head Start and Follow Through Planned Varieties Models, to loosely connected workshops or university classes. Most of the programs aimed at improving the reading and mathematics skills of elementary school children. The instructional variables addressed in staff development ranged from learning to use a new curriculum (e.g., new math), to organizing classroom activities and student behavior, to working with parents and classroom aides.

After several years, it became fair to ask the results of all this effort to improve instruction: (1) Did teachers change behavior and implement programs as intended? (2) Did student attitudes, attendance, and achievement improve as predicted? In the late 1960s and mid-1970s funding agencies demanded an accounting. Except for the direct instruction model (see Rosenshine 1982), most of the innovative programs came up short (House and Glass 1977). The public outcry has been long and loud, and favor has shifted to curriculum basics. Does this mean the other innovations were bad ideas? I don't think so.

The lack of valid and reliable group-administered tests for some important predicted student outcomes (e.g., problem solving) presented a serious problem. Most studies did not have the means to develop criterion tests. Another problem was that most of the staff development programs did not assess whether the teachers were using the information as prescribed in the classroom. Without this information, it was difficult to know whether the training program, the testing program, or the innovation was faulty. If, for example, the idea of using small groups for cooperative learning is poorly communicated during the training, teachers are not likely to make the vital connections of who, why, when, and for what purpose. At the next check point, if teachers do understand the innovations conceptually, they still may not be able to connect that idea to their work in the classroom. For student learning to occur, all of the connections must be made. Too often we evaluate the idea by the student results and the connections in delivering the idea are not examined.

The point is that a good idea may be lost if the training program itself is not monitored, evaluated, and improved. If one out of 10 teachers do not learn to use the information, that one teacher needs more attention. If five out of 10 teachers do not implement the program, then the training methods and program curriculum must be examined. For improvement of the training program, the model must have a plan that allows trainers to check for teacher understanding and usage at several critical times during training.

An Accountability Model

How do you know whether the staff development program you are using is effective? Is it effective with all teachers or some teachers? Is each component equally successful in bringing about the desired teacher behavior? if it isn't a complete success, what should you change? To answer these questions, specific data are needed.

Every staff development model includes a curriculum and a delivery system. Curriculum means content; delivery means when, where, how, and number of participants. Good content with poor delivery, or vice versa, is not likely

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to be effective in bringing about change in teacher behavior. To increase the chances of success, teachers and administrators should help select both curriculum and delivery system.

Once the objective of the staff development program is decided and everyone agrees on where, when, and how the training will be provided, it is important to know at what level each teacher is performing on the variables of instruction. Teachers differ in experience and skills and the program must be adapted to individual needs. To this end, our "Effective Use of Time" training model was developed (see Table 1).

Table 1

An Accountability Model

Baseline/Pretest
- Observe teachers.
- Prepare individual profiles of behavior.
- Assess what change is needed: make recommendations.
- Start where teachers are.

Inform
- Provide information.
- Link theory and practice.
- Check for understanding: Elicit practical examples.

Guided Practice
- Provide conceptual units one at a time.
- Help teachers adapt to own context and style.
- Assess and provide feedback.
- Obtain commitment to try a new idea in class the next day.
- Support and encourage change.

Post-test Observations
- Observe teachers: Prepare second profile
- Provide feedback to teachers.
- Assess training program for effectiveness.

The substance of this paper is derived from a research-based staff development model used in secondary classrooms (Stallings, Needels, and Stayrook 1979). The study included an initial observation and assessment of teachers on 31 variables derived from teacher-effectiveness research (Stallings, Needels, and Fairweather 1978). After a series of five two-and-one-half-hour workshops aimed at helping teachers increase or decrease specific behaviors, a second observation assessed the teachers' change and implementation of the training program.

Although the model has been used successfully with over 1,000 inservice teachers between 1979 and 1983, its applicability for preservice education remains a twinkle in this author's eye and is open to discussion. The components of the model are described below.

Baseline/pretest. This model starts with the teachers' behaviors and attitudes. Almost any inservice program can follow this model. If the program's objective is to reduce stress, then you need to make an assessment of the stress level before and after the training program. A teacher-stress questionnaire could be used.

Our inservice program aimed at helping teachers use time more effectively. The teachers were observed objectively and their use of time recorded before any intervention was offered. Based on that objective observation, a profile of each teacher's use of time was prepared and recommendations for change were made (see Figure 2). Sarah Smith, in the example, was encouraged to decrease her working alone time to 3% or less during the class period. The recommendations to Sarah Smith were based on the criterion from research findings in several studies of effective time use in secondary remedial reading and math classes. The criterion would be different for writing, shop, art, or any class requiring a lot of in-class guided practice. For staff development, it is important to establish some rough criteria or a range of acceptable performance. In addition to the observations, teachers may rate themselves before and after the intervention on the skills being learned. This provides baseline and post-test information on teacher knowledge of the innovation and awareness of their behavior.

Inform. Teachers are asked to read about the findings from the research on teaching. These findings are discussed in terms of child development and learning theory. The theory is linked to practice; teachers' understanding of the concepts is assessed by asking them to share practical examples of how the research findings could be used in the classroom. A central feature of this model is that learning takes place only when connections are made between a person's prior knowledge and new information. This approach is supported by the research of cognitive psychologists such as Ausubel (1968) and Broadbent (1975).

Guided Practice. Guided practice helps teachers learn the recommended processes. In some cases, reading materials alone may aid a teacher to gain the required skills. Emmer and Evertson (1980) produced excellent suggestions for classroom organization and management. Other teachers may learn best by observing another teacher or by receiving modeling or coaching from the trainer. The necessary ingredient for change is the teacher's commitment to try something new in the classroom tomorrow: The trainer's job is to facilitate the teacher's efforts by providing the necessary information or experience. Following are several effective approaches to guided practice.

- *Provide a conceptual unit.* It is important not to overwhelm the teacher with too much information. We present one conceptual unit at each training session. For example, the second workshop focuses upon classroom management.

Figure 2

Profile of Sarah Smith

Activities per % of Time	R*	Criterion	Criterion Percent	Teacher Baseline Percent	Teacher Post-Observation Percent
Preparation					
Making Assignments	More	X	10	8	
Organizing	Less	X	2.5	7	
Teacher Working Alone	Less	X	2.5	15	
Interactive Instruction					
Review/Discussing	More	X	10	6	
Informing	More	X	25	14	
Drill/Practice/Test	More	X	9	2	
Oral Reading	More	X	6	2	
Noninteractive**					
Doing Written Work	OK	X	20	20	
Silent Reading	Less	X	15	20	
Off Task					
Students Socializing	Less	X	2.5	8	
Students Uninvolved	Less	X	2.5	15	
Teacher Disciplining	Less	X	1	6	

*R = Recommendations
**Students Work Alone.

Teachers read the research and examine their profiles for the organization and management variables. In the case of Sarah Smith, twice as much time is being spent in preparation as is recommended. Suggestions will be made by other teachers for efficient ways to take the roll, make assignments, pass materials, group students, and make transitions. Sarah will consider these ideas and make a commitment to try something new in her classroom tomorrow.

Three other conceptual units are studied in the remaining workshops. Those units are managing and motivating students, providing interactive instruction (questioning techniques and feedback), and structuring information. Teachers receive guided practice for each unit.

- *Modeling and coaching*. Modeling and coaching are effective ways to guide practice (see Joyce and Showers 1982). Some teachers may need extra help with some behaviors such as grouping for reteaching. Many secondary teachers have not been trained to work with two or three groups. Learning a new procedure such as this is likely to require in-class modeling and coaching by the trainer. It may also be helpful if the teacher who needs help observes another teacher working with several groups of students.
- *Peer Observation*. Essential to peer observation is an agreement that such observations will be confidential. Trust cannot be established if a teacher hears his or her classroom discussed by other teachers in the lunchroom. Once trust is created, peer observation can be a satisfying and inexpensive method of providing monitoring and feedback. Teachers like it because while observing in another classroom, they usually pick up good ideas and at the same time provide the observed teacher with objective and useful information.

  When well-focused, peer observation has been found to be very effective in improving practice. Mohlman (1982) found teachers who observed each other using seating charts (to record off-task students and to show teacher-student interactions) changed their instructional practice in recommended ways more than did other teachers. (During the observations, the observing teacher marked each student by name and by activity.)
- *Assess and provide feedback*. During the scheduled workshops, teachers analyzed their seating charts to assess, for example, whether the seatwork of the uninvolved students might be too difficult or too easy, or whether some students would benefit from changing seats. If many students were off task during certain activities or

during the last 10 minutes of class, the lesson plan itself was assessed.

Using an interaction seating chart record, teachers quickly saw patterns of interaction. One teacher noticed that most of her interactions were with students in the right front quadrant of the room. There was a hearing-impaired student in that section, and in her effort to speak so that that student could understand, the teacher was ignoring other students. By moving the student to the front and center, all students received attention.

Another use of the interaction seating chart is to analyze the kinds of questions the teacher asks, e.g., simple memory, thought provoking, or clarifying. In a workshop, teachers discussed when to use different questioning approaches and shared examples. They also analyzed how frequently they gave specific praise and acknowledgment for correct answers and the kinds of correction they gave for wrong answers. Research from several studies has consistently indicated that teachers who provide specific praise and support for correct responses and guiding, corrective feedback for wrong responses have students who achieve more and attend class more regularly (Anderson, Evertson, and Brophy 1979).

Post-test observations. After teachers have practiced the processes they are learning, they are observed again and given a second profile. This provides a graphic way for each teacher to see on what variables change occurred. The trainer looks at the efforts over all the group and assesses the success of the program. Teachers are asked what they found easy, difficult, and useful about the training. This information helps trainers improve the training program.

The Process

The workshops are solution oriented even though research based. Teachers often need to discuss problems regarding students, parents, or administrators that hinder implementation of the program. These problems are listened to respectfully, and practical solutions are generated by the group. The model insists that people grow best when they feel supported and safe. Teachers must feel that mistakes lead to learning. The aim is to make teachers good learners.

The Research Base of the Accountability Model

This accountability model emerged from a two-phase study funded by the National Institute of Education. In the first phase, Stallings, Needels, and Fairweather (1977) identified effective teaching practices in secondary reading classes by correlating observable teacher behavior with students' test scores. These findings are presented in Table 2. In the second phase, an experiment was conducted by Stallings, Needels, and Stayrook (1979). The goal of the experiment was to change the behavior of secondary remedial reading teachers to reflect the findings of phase one. The experiment was unique in its attempt to measure teacher performance on specific variables and compare that performance to a criterion. Other experiments only measured significant teacher change. Clearly, some teachers will perform acceptably on some variables, and change will not be required. These teachers should receive credit for implementing the variable, even though no change occurred.

Table 2

Significant Correlations of Reading CTBS Scores and Instructional Variables

Interactive, On-task Instruction (Positively related to student gain)
  Review/discuss homework or seatwork
  Students reading aloud
  Praise and support
  Teachers guide to correct solution
  Teacher instructs/chalkboard

Organizing (Negatively related to student gain)
  Organizing interactions
  Teacher organizing (alone)
  Teacher not interacting
  Teacher offers students choices
  Teacher/outside intrusion

Seatwork (Noninteractive, On Task) (Negatively related to student gain)
  Student silent reading
  Sustained silent reading
  Written assignments

Off Task (Negatively related to student gain)
  Social interactions
  Negative interactions

To conduct this experiment, groups of 25 treatment and 19 control teachers were observed in the fall, winter, and spring. (See Stallings, Needels, and Stayrook 1979, for details of the observation system and methodology.) The treatment teachers received the series of five workshops described previously. The control teachers were given initial information about the study and a promise of training in the spring.

Analysis of Teacher Change

Once the workshops were delivered and the pretest and post-test data collected, the question was: Did the work-

Table 3

Interactive Instruction

Academic Variables	Grand Mean		Treatment Teachers (N = 25)				Control Teachers (N = 19)			
			Score	Fall X̄	Winter X̄	Spring X̄	Score	Fall X̄	Winter X̄	Spring X̄
Instruction activities	12.0	>	+	13.0	15.0	15.0	0	11.0	9.0	8.0
Instruction interactions	54.3	>	+	66.3	44.3	58.3	0	53.6	50.0	44.4
Teacher questions	31.1	>	+	37.2	33.0	31.7	0	40.2	33.9	25.8
Student responses	28.8	>	+	33.3	29.0	29.1	0	34.8	29.2	25.3
Praise/Support	12.9	>	+	12.6	13.8	15.2	0	13.4	12.4	11.6
Corrective feedback	12.7	>	+	10.4	10.8	13.0	0	16.6	12.1	12.4
Probing questions	1.5	>	+	1.3	2.2	3.0	+	2.8	1.5	2.0
Students reading aloud	17.3	>	0	10.7	13.8	13.8	0	14.4	13.7	16.1
Total + Implemented			7				1			

> = Treatment teachers were directed to perform these activities above grand mean.
< = Treatment teachers were directed to perform these activities below grand mean.
+ = Variable implemented.
0 = Variable not implemented.

shops make a difference in how teachers performed in their classrooms?

Mean frequencies for the 31 variables used on the teacher profiles were computed for the control and treatment groups. Table 3 shows how each group performed on critical interactive instruction variables. Similar tables were constructed for organizing, seat work, and student behavior. Treatment and control group scores were compared with a grand mean, or the criterion. The grand mean was derived from 87 classrooms in two of four prior studies of effective teaching. This mean reflected the frequency or percentage of the behaviors and activities occurring in classrooms that were correlated with student gain. Our recommendation to teachers in the treatment group was to increase or decrease a particular behavior or activity so that the occurrence was above or below the grand mean, depending on whether the variable was positively or negatively correlated with gain. For teachers already performing the activity within an effective range, the recommendation was to continue as they were doing. If teachers in the treatment or control group were performing above or below the mean as recommended on a variable, they received one point. This is shown in Table 3. In this manner, an implementation score was developed for each teacher and each group. As indicated in Table 3, the treatment group implemented seven of the eight instruction variables acceptably in the spring.

Training Results

Overall, the treatment teachers changed behavior in the directions recommended. A late spring observation indicated that treatment teachers maintained most of their behavior changes, whereas control teachers' classes became more lax and less task oriented. The treatment teachers actually changed behavior on 25 out of 31 variables, whereas the control teachers implemented only seven of the variables. The task for the researcher was to improve the training program so that the six variables that were not implemented would be implemented in future training efforts.

Student outcomes. The primary question for any classroom or school study is: Did the treatment group's students differ significantly from the control group's students on selected outcomes? To answer this question regarding reading, we used those classrooms that had sufficient students with reading scores available for spring 1977 and spring 1978. This yielded a sample of 15 treatment classrooms and 14 control classrooms. The attrition from fall to spring in the number of classrooms with sufficient student test data was quite high (from 44 to 29). Although the original 25 treatment classes and 19 control classes started the study with comparable groups, we found that the 19 treatment-group classes with sufficient student scores were considerably lower on the pretest than was the control group (see Table 4).

The average for the treatment group was the grade equivalent of 5.7, and the lowest classroom score was 4.1. This is contrasted by the control group's average pretest score of grade equivalent 7.2 and the lowest class score of 5.8. The tests given in each class were selected for appropriate reading levels so that there would not be a topping-out effect on post-test scores. Data in Table 4 indicate that the

Table 4

A Comparison of the Reading Test Scores For
The Treatment and Control Groups of Teachers

	Pretest			Post-test			Gain	
	X̄	S.D.	Range	X̄	S.D.	Range	X̄	Range
Treatment (N = 15)								
Standard Scores	456.04	42.01	399.7 to 538.6	510.89	41.65	433.4 to 610.0	50.45	17 to 112
Grade Equivalent	(5.7)		(4.1 to 8.3)	(7.5)		(5.1 to 10.7)	(1.8)	(.7 to 2.2)
Control (N = 14)								
Standard Scores	499.79	34.75	461.3 to 590.0	537.41	38.67	476.1 to 624.8	37.90	11 to 75
Grade Equivalent	(7.2)		(5.8 to 10.2)	(8.4)		(6.3 to 11.1)	(1.2)	(.3 to 2.2)

treatment group averaged a 1.8 grade-equivalent gain. This is impressive, given that this group included students who rarely made any gain. The difference in gain between the treatment and control groups is significantly different ($p < .08$). The reader is reminded that it is difficult to obtain significant differences with small samples. Nevertheless, the educational significance here is the six months' greater gain by the treatment group over the control group. Such achievement is difficult for secondary students with a long history of failure.

Application to preservice education. Could this accountability model be useful in teacher preparation? I think so. Education students could start learning to use focused observation systems during their first, second, and third years of undergraduate work. These observations could range from ethnographic recordings to systematic, objective systems. During the year of student teaching, the model could be used to inform student teachers of their progress toward goals. Supervisors could use this system to provide specific feedback to students. However, this author feels that a better plan is to have student teachers observed by other student teachers during their first month in the classroom. This provides the opportunity to learn from observing another student teacher, and the student teacher being observed receives specific information from the profile of behavior generated. The supervisor could use these profiles as the focus of group discussions with student teachers to guide their practice teaching. Essentially, the teacher candidates would learn through observation of others as well as through being observed by their peers. The candidates might then receive systematic, objective feedback several times during their classroom experience. This model for preservice education would require the same kind of supportive atmosphere and interaction as described for inservice teachers.

Conclusion

The National Center for Educational Statistics projects a need for over 900,000 new teachers between 1985 and 1990. This need may arise in part from an increase in school populations—the result of a rising birthrate—and from the expected retirement of teachers who began their careers teaching the children of the baby boom of the 1940s and 1950s.

With this possibility of a teacher shortage on the horizon, the spotlight has fallen on preservice education. Teacher preparation institutions must relentlessly ask: What is needed in our classrooms today? Do our teacher training programs meet these needs? An approach such as the one recommended here could help teacher educators test and evaluate well-worn curricula. While the research on teaching and teacher training does not have all the answers, its findings may help guide the way toward more viable models for teacher preparation.

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Closing

Teacher Education in Transition

B. Othanel Smith

What I have to say is neither new nor difficult, although it may be contentious. I speak not from figures and facts but from my sense of events and of the climate of opinion now forming in pedagogical colleges, public schools, and state departments of education. The only merit I claim for my observations is that they are either true or plausible and, I hope, constructive.

For some time, we have discussed the reform of preservice pedagogical education in terms of extended time and financial support. These are important and essential elements in any reform. But I want to address another kind of transition, one that is taking place before our eyes and yet is little recognized.

It is an intellectual transition: a reform in our ways of thinking about pedagogical knowledge, a new-found confidence in that knowledge, and a tendency to think more objectively. I want to indicate also how the profession is becoming competitive in the labor market, an idea now shaping in the minds of an increasing number of people.

But before I discuss any of these, it is appropriate to treat briefly the force driving faculties of pedagogy toward reform. We were once fond of saying, as H. G. Wells told us, that "Human history becomes more and more a race between education and catastrophe," and we had little doubt that education, properly conceived and conducted, would win the race. Although we are less sanguine today, we still rally to the call for more and better education. But we do so for less universal reasons than the salvation of humankind.

We are told daily that we are falling behind this and that nation in science and technology and production; that our people are unprepared in mathematics and the social, biological, and physical sciences. These claims are not without merit. As in past crises, the schools have become the target of the complaints. In the view of critics, colleges of pedagogy, suffering, it is said, from intellectual poverty and flabby standards, are the root of all these deficiencies. While the colleges are not without fault, they are not alone responsible for the decline in schools' influence. There are many other causes, not the least of which is the persistent apathy of the public and its political spokespersons.

Nevertheless, these critics are causing some of us to become deeply apprehensive about the future of colleges of pedagogy. I do not wish to belittle the critics. It is right and proper that they criticize and that we listen and respond.

But we should not be misled. Underneath their complaints is a deeper concern, generating and sustaining them. It is the uneasiness of people about their capacity to keep abreast of the unprecedented acceleration of knowledge and their ability to comprehend the problems that confront them.

They see social and economic problems, not to mention relations among nations, increasing in complexity at a rate far greater than the universities and schools are increasing their capacity to clarify them. Just as students become anxious and frustrated when they recognize that more information is being given to them than they can assimilate or that the problems are more than they can handle, so a society becomes uneasy and anxious when it becomes aware that the problems are too complex and that the rate of knowledge production overtaxes its ability to absorb. This is particularly true in a culture in which the art of persuasion, an art that presupposes an informed people, is the chief instrument of social direction and control.

This, then, is the crux of the matter: the gap between the rate of knowledge production and the increasing complexity of the social context, on the one hand, and the capacity of institutionalized education to disseminate that knowledge and clarify the social context, on the other hand. That gap grows wider daily.

There was a time in the early days of my career when I could understand, at least to my satisfaction, the discoveries for which Nobel laureates were honored. But today my knowledge is so outdistanced by science and technology that I have only the slightest glimmer of the discoveries of these men and women.

It is this unarticulated feeling that the knowledge base of their lives exceeds their comprehension and that social difficulties are out of hand that people unwittingly respond to when they criticize the schools and the preparation of teachers. In this context, the dual task of pedagogical colleges is to contrive ways of accelerating learning and to prepare personnel to administer them.

The transition from brain to books, especially printed books, for the storage of information was the first great leap in the acceleration of learning. We are now on the springboard of the second geat leap: from books to electronic brains. This transition will likely stimulate as much change in pedagogical knowledge and skills as did the evolution of books. But the full benefit of the electronic brain lies down the line; how far down we do not know. Nor do we know how much of our current pedagogical knowledge and skill will then still be valid. But I suspect more of it will be useful then than we have thus far put to practice.

Clinical Knowledge: Our Changing View of Its Source

The first important feature—not first in time but in significance—of the pedagogical education now emerging is the central role that clinical knowledge plays. We are becoming keenly aware that the rate of learning may be accelerated by building into programs of instruction the clinical knowledge we have already.

This is a trying task, for the validity and utility of clinical knowledge is constantly at issue. It is partly this fact that is obstructing the improvement of pedagogical schools and retarding the rate of learning among students at all levels of formal education.

This controversy about clinical knowledge springs from failure to understand the nature and function of pedagogical knowledge. This knowledge is found in theoretical courses. Among these are psychology, philosophy, and measurement. Clinical knowledge comprises the content of courses in procedures and techniques of teaching, curriculum development, and intern work.

When I was a graduate student, it was generally believed that clinical knowledge was derived from academic knowledge, some authorities holding that such knowledge was derived from psychology, while others were equally convinced that philosophy was its source.

The belief that clinical knowledge stems from psychology came largely from Edward Lee Thorndike. In his doctoral study of animal intelligence, Thorndike suggested that effective teaching conforms to the laws of learning. This reliance upon psychology for clinical knowledge continues to dominate the thinking of a large proportion of pedagogical faculties, although other brands of psychology, notably Skinner's behaviorism, have replaced Thorndike's connectionism, while cognitive psychology now promises to become the popular brand.

Those who were persuaded that clinical knowledge is derived from the concepts and principles of philosophy were disciples of John Dewey. They claimed that teaching procedures were derivable from the theory of inquiry set forth in Dewey's *How We Think*. Teaching was largely a matter of helping students engage in inquiry. Like psychology, new philosophies have come upon the scene, but the thesis that philosophy is the source of knowledge about how to teach lives on.

Both of these positions were wrong then and they are wrong now, although each contains just enough truth to be seductive. Like Aristotle who claimed that women had fewer teeth than men but did not look into the mouth of any of his wives to check his claim, proponents of these views never examined teaching. They supposed that teaching was a malleable phenomenon, that patterns of behavior derived from extraneous sources could be imposed upon it.

We are only now beginning to see that teaching, like political and economic behavior, is a natural phenomenon to be studied in its own right. This does not mean that academic pedagogy is irrelevant to the study of education, but it does mean that effective teaching behavior does not consist of mere deductions from the concepts of philosophy and psychology.

When we turn to the classroom and begin to study what effective teachers do when they teach, we begin to discover clinical content. Today, we are accumulating a substantial body of dependable clinical knowledge from process/product and experimental studies. The reports of research in this volume demonstrate the efficacy of this approach.

However, we cannot long continue to build the knowledge base of pedagogical education by simply discovering what effective teachers are doing. That procedure gives us a first approximation. We must go beyond that by formulating and testing new ways of increasing student achievement and refining those we already know. This we must do if we are to expand our pedagogical knowledge and further reduce the gap between knowledge discovery and its assimilation.

Clinical Knowledge Comes into Its Own

We are beginning to understand that clinical work is of paramount importance in schools of pedagogy. From the very beginning of pedagogical education in colleges and universities, the disciplines we considered important above all others were those we now call foundation courses. These included psychology, history, and philosophy. Teaching methods, or any course dealing with practical matters, was considered less important and less respectable.

This difference in the value assigned to courses is easy to understand. The foundation courses were those most closely associated with the traditional liberal arts curriculum and were hence more respectable in the academic community.

Emphasis upon academic studies has been retained with only a slight increase in emphasis on the role of clinical work. The tendency in recent years to bring into pedagogical schools professors from the disciplines of history, sociology, and the like from liberal arts colleges is witness to that fact. This hankering for academic respectability is understandable historically but makes little sense in a professional school where clinical work has been so long neglected.

To the clients of a profession, the primary benefit of professional schools is the ability of graduates to deliver service effectively. This can be attained only where a clinical program is the core of the curriculum and where academic professional studies are instrumental to the comprehension of professional practice.

During this century, the knowledge base of clinical practice has grown steadily. A mass of knowledge has accumulated with respect to the teaching of specialized studies such as reading, mathematics, and so on. During the last 30 years, a substantial body of knowledge has accumulated in what we may refer to as generic clinical knowledge and skills. These two bodies of clinical knowledge have advanced to the point that we no longer assign the clinical program to a secondary role.

It is unfortunate that faculties of pedagogy should have thought for so long a time that there was only one kind of significant knowledge, namely, those concepts, principles, and facts that make up academic studies. The rest of the pedagogical program was considered little more than skills, requiring practice plus a modicum of explanation. The real intellectual work of the student, it was claimed, took place in academic professional courses.

However, we are now coming to see that there is just as much intellectual challenge in mastering, for example, the concept of praise, the various ways and conditions of using it, and learning to perform in the classroom in accord with the rules governing the use of praise as there is in the mastery of a particular concept or principle of philosophy or psychology.

This perennial failure to see the intellectual character of clinical studies may be attributed to the fact that clinical knowledge was not understood. By nature, clinical knowledge is tied to objectives. We did not see that its propositions say that if you want certain ends attained, then do thus and so if the conditions are so and so.

An example: If a teacher wants to encourage good conduct and achievement, then one way to do this is to use praise. But, in addition, the teacher must know what kind of praise to give and under what conditions to give it. If the students are above the primary grades, then the teacher should use specific praise, that is, praise that indicates the particular conduct or academic behavior for which the student is being praised. The praise should also be low key and reflect spontaneity, simplicity, and warmth.

The teacher must know also that boys and girls react somewhat differently to praise; that girls are particularly encouraged by praise but are discouraged by criticism; that boys, on the other hand, tend to discount criticism and are less encouraged by praise. Further, the teacher should understand contingent praise and how to counteract the reinforcement that a student gets from peers when he or she misbehaves. From what has just been said, it is needless to add that clinical knowledge does not hold in every case and is hedged by qualifying conditions, exceptions, and exclusions.

While academic pedagogical knowledge is also probable, such knowledge is not tied to objectives and gives no prescription for attaining ends. For example, it is known that many lower-class families give their children little encouragement to continue education; some even discourage it. This sort of information is typically taught in academic professional courses. Such information enables teachers to understand particular students' lack of motivation. But academic knowledge has no capacity to generate what the teacher can or should do to encourage lower-class children to become interested in learning. Or again, we learn from Piaget that the child begins to think in formal terms at about age 12. This information is important to the teacher, for it can be used to justify the placement of content and problems in the school program. But it yields no prescription for the teacher to follow in teaching laws or lawlike principles.

The Role of Theoretical Knowledge

We are becoming aware that the concepts of academic pedagogy are explanatory rather than prescriptive. The primary function of the concepts and principles of pedagogical psychology, for example, is to account for the effects of particular teaching procedures and techniques and to justify decisions about instructional programs.

We have long thought that psychology tells us how to teach; that teaching behavior that departs from psychological theory is somehow wrong. I recently heard a professor of psychology say disapprovingly that a particular teaching behavior whose effectiveness was vouched for by both process/product and experimental research did not square with his theories of personality and learning. In effect, the assertion asked the practitioner to justify the practice. In this instance, the professor understood neither the function of psychological knowledge nor his task. In empirical professions such as medicine, agriculture, and pedagogy, it is the function of the underlying sciences to explain what research shows to be effective treatments. This psychologist should have asked the question of himself.

A few years ago, I asked a theoretical physicist what he did. He told me a number of things, one of which I remember distinctly. It was that the theorist explains what the experimentalist has done. He puts experimental results into a system of concepts and principles so that they may be understood. Although pedagogical knowledge is a far cry from physical knowledge and will remain so, it is enlightening to find that theory functions in the immature sciences as it does in the highly developed sciences.

Effective treatments typically run ahead of explanations. Aspirin has been used for decades to relieve pain, but medical science has only recently begun to understand how aspirin works. So it is with treatment after treatment. We have known for many years that almost-ripe tomatoes will ripen faster under cover than in the open. But we did not know why. We now know that this effect is due to trapped hormones that affect ripening.

It is equally true that in pedagogy, effective practices typically develop independently of explanations. Here is a case in point: We know from research that general praise of student behavior has positive effects in the first and second grades but much less so in later grades. Why this discrepancy? That question belongs to the psychologist, not the practitioner. Some psychologists explain this difference by recourse to attribution theory. Advanced students may discount general praise, attributing success to causes over which they have little or no control, while young children take praise at face value.

Consider another example. We know from experimental studies that teachers who give definitions, identify criterial attributes, and then give practice in applying the criteria to examples and nonexamples are more successful in teaching concepts than are teachers who give either definitions or examples alone. Why is the first mode of teaching more effective? Some psychologists would appeal to schema theory. We suppose that the rule-example-rule approach develops schemata. These mental patterns then enable the learner to interpret observations, think at abstract levels, make inferences, and solve problems. The schema theory is in its infancy but it appears to have good explanatory potential. Such theoretical explanations may add a new dimension to the teacher's comprehension of this procedure of concept teaching.

As clinical knowledge accumulates and is incorporated into instructional programs, pedagogical psychology will become more theoretical and explanatory as a component in the preservice program. Indeed, it is questionable that concepts and principles of learning and development should be taught, at the preservice level, apart from their use in the interpretation and explanation of teaching procedures, program development, and instructional organization.

As psychology becomes recognized as an explanatory study and taught as such, controversy over the source of clinical knowledge will wither. Further, teachers will begin to appreciate the value of pedagogical theory, for they will begin to see that it enables them to understand how effects result from what they do. They will also gain confidence in themselves as professionals.

We have been considering psychology as a subject in a program of pedagogical preparation. Properly conceived, its function in that program is to provide theoretical concepts and principles to explain behavior, to account for the effects of procedures and techniques, and to justify decisions about programs.

As a research discipline, psychology is not a preservice study but a higher-level professional and research study. From its concepts may be derived clinical hypotheses for experimental testing. But until the hypotheses are tested and their effectiveness confirmed in schools, they should not be considered as clinical content nor included in preservice programs.

We Are Beginning to Think Objectively

That an increasing number of pedagogical faculty members and public school teachers are thinking about knowledge and performance in scientific terms is one of the most promising characteristics of the emerging orientation. As a profession, we are beginning to recognize an objective world of psychological, social, and cultural facts in the classroom independent of our perceptions. We are beginning to distinguish accidental associations of unrelated events from events associated by statistical laws; to see the difference between procedures that result from linguistic alchemy and those anchored empirically in the laws of probability.

While there is still a distinct tendency to account for effective teaching by reference to the style and personality of particular individuals—the good teacher or the strong principal—a growing number recognizes the fact that explanations are found in solid theory, statistical correlations, and experiments.

It is commonly accepted that caution should be exercised in the evaluation of that which is called scientific. This is true in any empirical profession, but such caution should not be taken as rejection of any and all statistically based knowledge. Statistically related variables of teacher behavior on the one hand, and of student conduct and achievement on the other, are not necessarily accidental. They are not of the same order as a positive correlation between the number of bananas shipped into Tampa and the number of deaths in India during a given year. We recognize this distinction when we use such expressions as "tends to" or "follows from" when speaking about positive statistical relations among classroom variables. We do this because we know there are conceptual grounds supporting the relationship, grounds that do not exist in the case of the relation between the rate of banana importation in Tampa and the death rate in India.

While we always need more rigorous investigations of classroom culture, teacher acts, student reactions, and the relation of these to achievement and conduct, we now have a body of knowledge about classroom variables—patterns and processes of teacher behavior—that affect how students feel, think, and act. How well teachers use this information, how skillfully they mold their classroom conduct in accordance with it, should not be confused with the reliability of that which has been analyzed and tested. This lesson we are learning.

This change in the attitude of pedagogical faculties and teachers toward professional knowledge is significant for a number of reasons, only one of which I shall discuss: The change in attitude will lead to objective instruction in the social sciences.

For well over half a century, we have urged schools to teach the procedures and skills of scientific thinking—to look objectively at any phenomonon, to analyze a state of affairs, to develop hypotheses by which to explain or change a state of affairs, to test these hypotheses, and to maintain a healthy skepticism even toward that which has been tested. We have thought that by such instruction we could produce generations of citizens who think objectively, if not scientifically, about pressing social problems. However, a pedagogical profession that thinks in emotional and ideological terms about its own behavior is unequal to the task of preparing students to think rigorously and objectively about their problems. Little wonder that the profession calls the social science curriculum "social studies."

But there are signs of an awakening. Faculties and teachers are increasingly receptive to the notion that there are facts out there in the psychological and social world and that we cannot impose on them whatever we want. They are beginning to see that even values have a factual base and are not merely subjective and personal. Today more than ever before, we are inclined to accept, or surely to entertain, research findings.

Challenging the Reward System

Another characteristic of this period of professional evolution is incipient change in the reward system of both pedagogical colleges and public schools. As clinical instruction becomes more significant, it becomes necessary that ways to reward merit for clinical work be contrived. Professors who are effective trainers in the skills of teaching, planning, and diagnosing will be promoted in rank and pay by criteria somewhat different from those for researchers and theoreticians. For a professional school to do otherwise would be incompatible with its purpose to produce high-quality professionals. That some colleges are beginning to examine their reward systems, to think about alternative criteria for promotions, indicates a new awakening to the crucial importance of clinical instruction and to a sense of what it means to prepare professionals.

The reward system of public schools is even less discriminating than that of colleges. Every teacher is locked into a wage scale according to which the incompetent teacher rises almost—if not as—easily as the competent. Increments on the scale depend upon amount of experience, amount of college work, and inservice training.

But none of these factors necessarily relates to the development of instructional competence. Experience is accumulated by simply holding the job. College courses can, and all too often do, have little impact upon classroom performance. And inservice development seldom pays off in greater competence. Yet these factors determine the distribution of teachers on the wage scale. The teacher is thus locked into a reward system that does not recognize merit, a system in which an uncommitted or even deleterious teacher may be and often is rewarded along with a committed, highly effective teacher.

Neglect of merit in the reward system is driving many of the more ambitious and energetic, if not the more intelligent, students into other professions and occupations. The effect of the reward system was little noted until recently, because teaching was almost the only occupation open to highly intelligent women. They staffed our schools, for they had nowhere else to go. But that time has passed. Today, women who yesterday would have been teachers are going into other occupations. And we are now losing career teachers of science and mathematics to industry.

The teaching profession must become competitive in the labor market if the schools are to hold even their present status. The profession may become competitive by instituting a genuine merit system of reward based upon competence as determined by cognitive examinations and performance evaluation. We have the knowledge and technical know-how to bring about such a development.

Unless there is a stairway of competence with larger rewards at each landing, individuals have little incentive to strive for greater proficiency. Teachers are no exception. Ours is a land of competitive cooperation and our school system, the profession, and the public will do well to recognize that simple fact.

Most states are developing, or have already developed, examinations and performance-observation instruments for deciding who shall be admitted to the profession. We are now becoming awake to the need for similar means of evaluating teachers and principals beyond the entry level. In time we will develop ranks among school personnel with differentiated pay. This is already in the wind in a number of states, stimulated in part by the scarcity of science and mathematics teachers. Once this development begins to take form, it will be easier to justify increases in state and local appropriations. Salaries can then become competitive with those of other occupations.

Further Observations

So far, I have ignored several components of the reform of preservice education now taking shape. Here are some significant ones.

We have not discussed the trend toward extended programs. Most of us agree, I think, that adequate preparation cannot be provided in four years. It cannot be provided even when the preservice preparation is plastered with the current master's program. Nothing short of five years in a reconstructed program will suffice. We are moving in that direction.

We have not considered the funding formula. All of us know that the full-time-equivalent formula is incompatible with high-quality instruction. We are moving, however slowly, toward a formula that can support a program in which an approximate 12-to-1 ratio can be allowed in clinical courses.

We have not analyzed the new relationship developing between pedagogical colleges and public schools. Members of the supervisory and instructional personnel of many systems are as knowledgeable as college faculty members. The colleges are beginning to recognize the competence of school personnel and to develop relationships with teachers and supervisors in student-intern and beginning-teacher programs. It is not unlikely that the near future will see superior teachers on the clinical faculties of colleges much as practicing physicians are members of medical faculties or attorneys-at-law are members of law faculties.

We have not dealt with the changing orientation of state departments of education. For a long time, college faculties and state department personnel have either ignored or antagonized each other. In some states, this adversary relationship is changing. We are beginning to recognize that our profession is socialistic, except for private institutions. The state owns the public schools and universities and those of us who teach in them are an arm of the state. State departments of education are part of the system. They are exercising more and more influence over pedagogical colleges. At the same time their personnel gain knowledge and know-how, exceeding in some respects the abilities of pedagogical faculties. That some state departments and colleges are working together more closely than ever before is a most encouraging development. It is unlikely that much further progress can be made apart from the concerted efforts of the colleges, state departments, and schools.

Despite the current fermentation and change in pedagogical colleges, state departments, and schools, this is not a period of great hope. Rather, it is a time for modest optimism. We must not forget that we are a crisis-oriented people, that underneath the recurrent splurges of the public to support, defend, and elevate education is a persistent apathy that takes over once the emergency wanes. If there is a moral, it is this: Make hay while the sun shines, for tomorrow it will rain.

Many of you may think that these incipient changes are nothing more than a mirage, that what I see are images in my head. It is, of course, possible that in the darkness of these days I have let a bit of sunshine lead me astray, that I have let my hopes invade my reason, that I have mistaken desires and ideas for reality. But I see these reorientations and changes emerging in my own state—in the public schools, in the colleges, and in the state department of education. And my talks and correspondence with people in various parts of the country strengthen my belief that I have not misread the times.

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